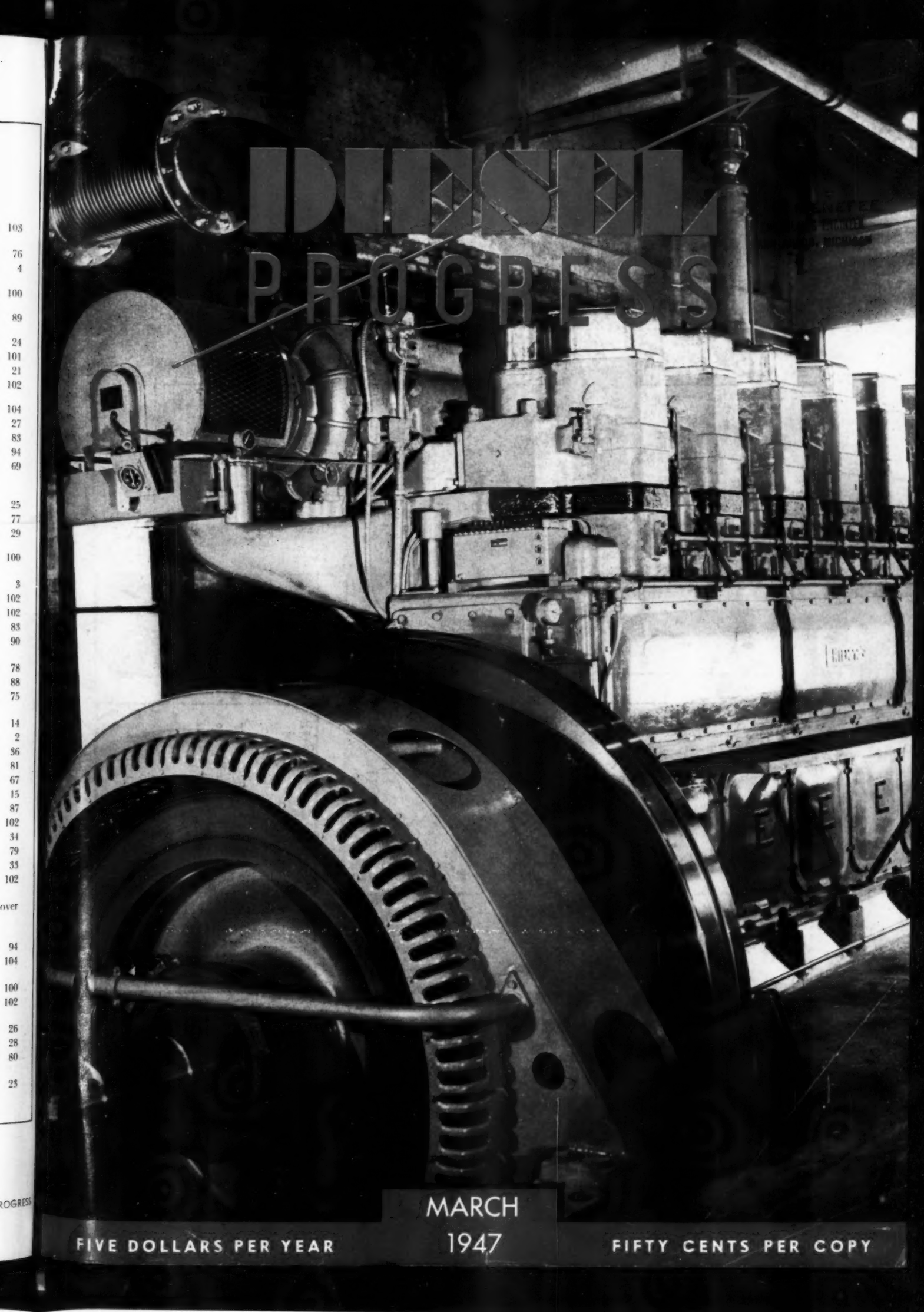
DIESEL
PROGRESS
MARCH
1947
FIVE DOLLARS PER YEAR
FIFTY CENTS PER COPY

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DIESEL and GAS ENGINE PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

FRONT COVER ILLUSTRATION: Denton, Texas, needed more generating capacity but had limited space. This compact, Elliott-Buchi-Turbocharged Enterprise Diesel with Elliott generator fits the available space and provides the needed capacity.

DIESEL PROGRESS for March, 1947, Vol. XIII, No. 3. Published monthly by Diesel Engines, Inc., 2 West 45th Street, New York 19, N. Y. Tel. MUrray-Hill 2-7333. Subscription rates are $5.00 for U.S.A. and possessions. All other countries $7.50 per year. Subscriptions may be paid the London office at £1-17s per year.

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124,000 TON MILES PER HOUR ON THE KA

World's Biggest Locomotive, the 8,000 HP. F.M. Diesel, Makes It Simple

THIS department recently dug into the operations of the nifty little Kansas City Southern Lines, 'way down on the Ozark Plateau, in the heart of America—in the Land of Lum 'n' Abner.

Kansas City Southern Lines, celebrating their 50th anniversary in 1947, began as an insurance man's dream of creating a fast, short outlet to tidewater for Kansas City, at Port Arthur, Texas, and a Southern lumberman's scheme to get Ozark & Louisiana timber to tidewater at New Orleans. The twin lines of promotion activity, one from the wheat-heart of America Southward and one from the timber country of the South Mid-West, resulted in the Kansas City Southern Railway, acquiring the Louisiana & Arkansas Railroad in 1939, and now operating a 1647 mile system known as Kansas City Southern Lines as a unified, high-speed system, farthest West of the three principal North-South railroad systems connecting the midwest cities of Chicago, St. Louis and Kansas City with the booming Gulf ports of Mobile, New Orleans and Port Arthur.

For 300 miles the Kansas City Southern winds, climbs and dips, across this region, up into open timber country as wild as the best of the region of the Rockies or Appalachians. With flat speedways at each end, the KCS has its traffic bottleneck between Pittsburg, Kansas, and De Queen, Arkansas, 302 miles. The Dutch capitalists who bailed the promoter's dream out, financially, left many of their race and many names along the mid-section of the KCS.

It was, therefore, quite logical that cagey President Bill Deramus, fiercely loyal to the Kansas City control of this railroad, was moved to reappraise the Ozark section of his railroad and plunge into Diesel as the final answer for sound operating practice on his line. But not until he had practically rebuilt the entire system into a ribbon of heavy steel, crushed rock ballast and easy curves, on a par with the finest railroad systems in the country. Some railroads plunged first into modern motive power, then started mending the roadbed. Not so with Mr. Deramus. He got his property built up to standards that would easily match those of the Pennsylvania or New Haven or even the Santa Fe. It is quite a surprise to dip down into this relatively little-known railroad empire and find a roadbed and facilities as downright excellent at the KCS. Dozens of its stations are of mod-

Engineer Lon Newcomer (circle) using Inductive Radio in cab of the new 8000 hp. F-M Diesel locomotive. Below, President W. N. Deramus, back to camera, inspects the new locomotive.

KANSAS CITY SOUTHERN!!

By Charles F. A. Mann

ern stone and brick; everything is painted and manicured with the pride of old Jim Hill and his Great Northern. There is definitely about $4 worth of fixed assets under each $1 of mortgage on the Kansas City Southern, and it is no wonder that when a man gets to be rich and influential in Kansas City, he forthwith becomes a backer and director of the Kansas City Southern, keeping the tradition of a home company, free of Wall Street domination, alive, year after year. Latest stunt is a $3,000,000 bridge reconstruction project on the Arkansas River, to match that $7,000,000 worth of Diesel locomotives and new rolling stock now being delivered.

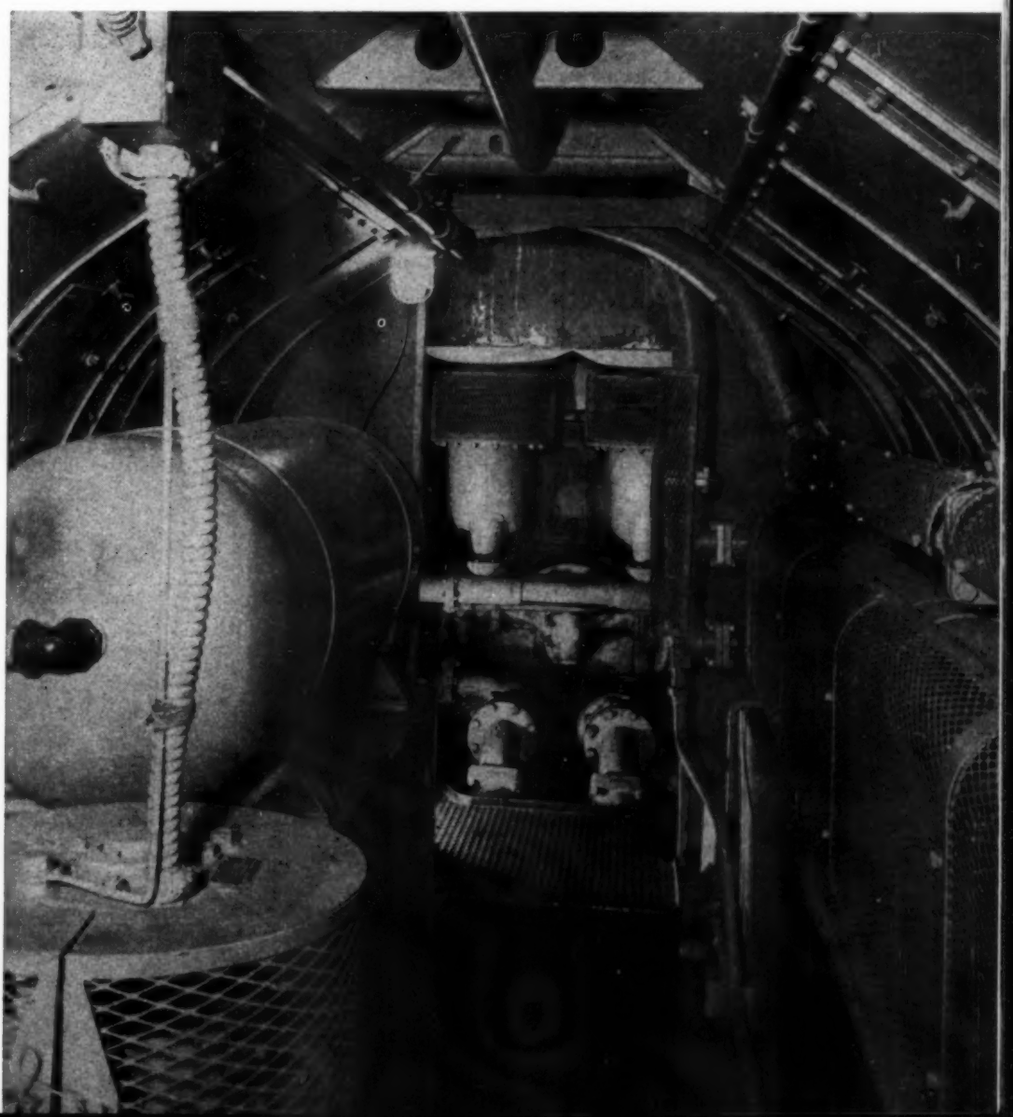
The big rolling stock order will permit twin daily Diesel streamliner service between Kansas City and New Orleans and also Port Arthur, as well as 100% Diesel operation clear from Pittsburg to De Queen, and by the time this is published, the last of the old-time steam locomotive gear, including shops, water and fuel stations, etc., will be torn down, except possible emergency facilities at Heavener and Watts.

It was quite fitting that the first bold upward step in application of Diesel motive power above the 6,000 hp. size on all railroads throughout the world, was undertaken by W. N. Deramus, able KCS president, early in 1946.

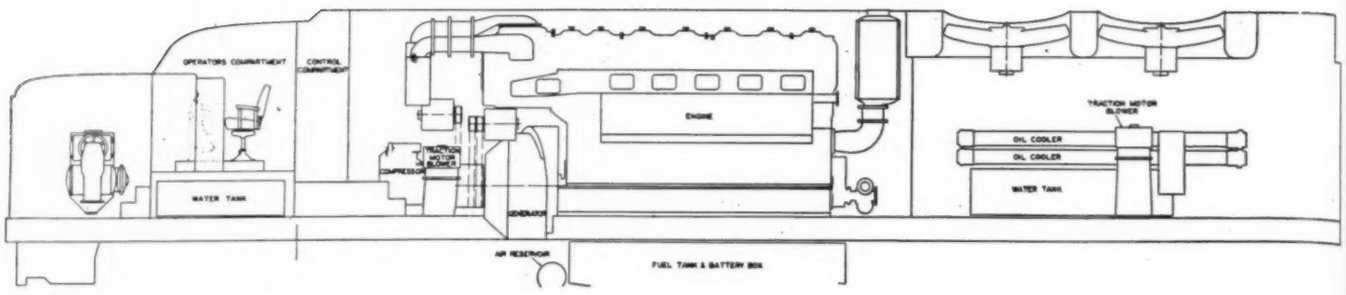
He ordered the 8,000 hp. 4-unit Fairbanks-Morse Diesel freight locomotive, after a study of traffic showed that in order to keep close to a 25 mile speed average, with 3700 to 5000 ton through, fast freight trains from Kansas City to Gulf ports, the Ozark Plateau bottleneck would require not 5400, or 6000 or 7500 hp. Diesel, but 8000 hp. in one locomotive, to avoid use of helpers and reduce to a minimum the total number of trains on this slow segment of track.

So Kansas City Southern Lines made railroad history last December—for about 48 hours, at first! The Great John L. Lewis shut the nation's coal mines down a few hours before the dedication of the 8000 hp. Diesel, so the ICC ordered it split into two 4000 hp. Diesels during the coal emergency, to save fuel. Later in December, it went back to work as an 8000 hp. 4-unit freighter, on the run originally set for it, and soon had set railroad eyes popping by handling, on one trip, from Heavener to Watts, on December 11, 1946, a 5473 ton, 107 car train, an average of 22.9 miles per hour and piled up for the 101 mile stretch, the astounding total of 124,287 ton-miles per train hour!

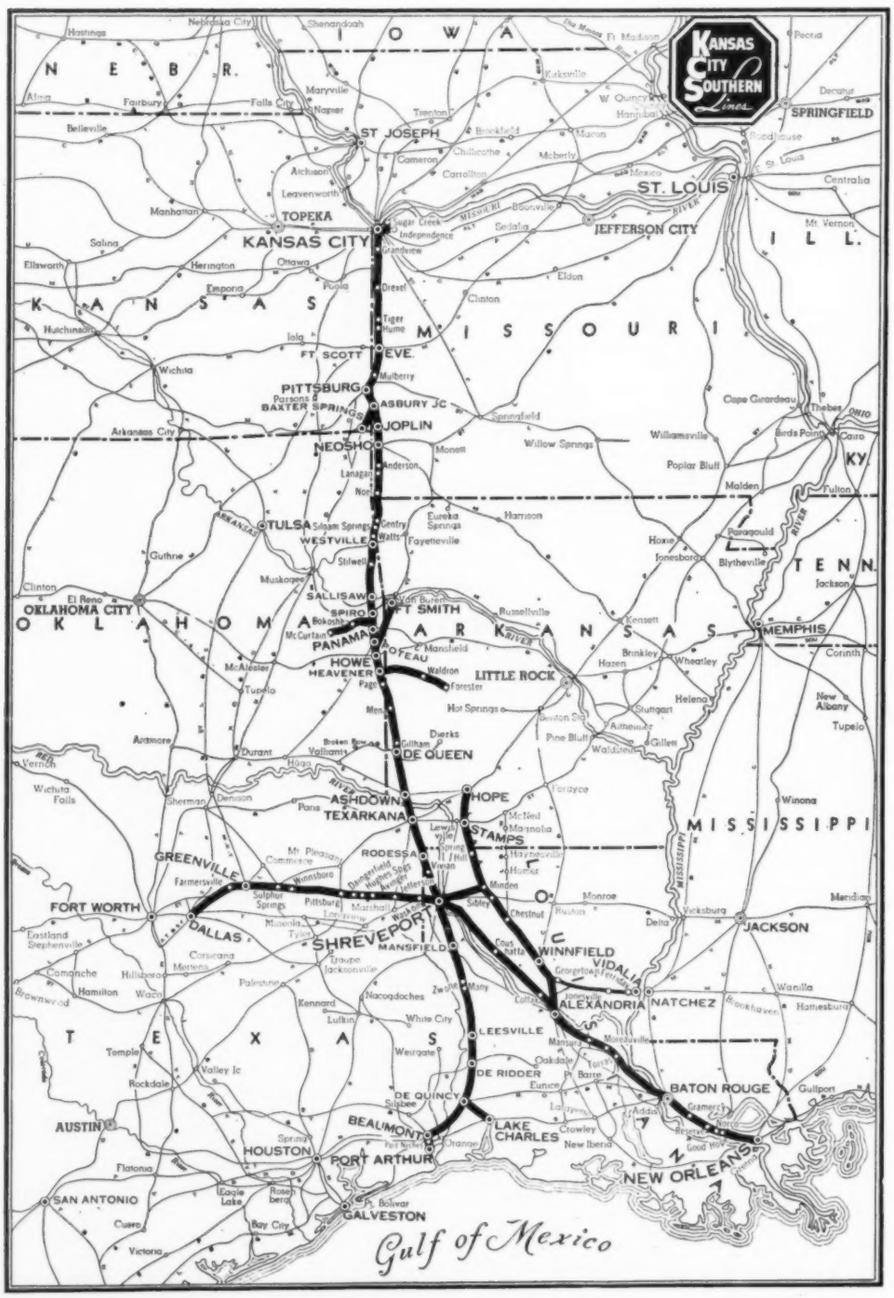
The system gtm. average for November, 1946, was 43,418 tons per train hour, which takes in the practically flat, fast, heavy operation on the Kansas and Gulf end of the system, were speed alone will sharply average upward the gtm. figure.



Interior view of cab showing auxiliary end of the F-M opposed-piston Diesel.



Above: Profile of the "A" unit. Below, map of Kansas City Southern Lines.

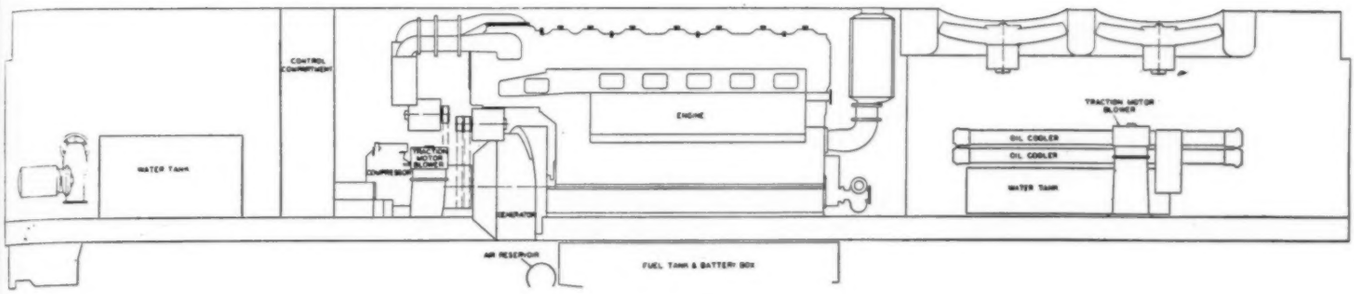


Yet in spite of this system average, the Fairbanks-Morse 8000 hp. Diesel averaged for 4743 miles of operation as a full-fledged 4-unit locomotive, a total of 93,417 gtm. per train hour, practically double the system average! Again, it must be borne in mind this record was made in rough, hilly territory with grades almost continuous from 1 to 1.8%, and speeds held below 35 mhp.

The KCS lines have some surprisingly young steam power of large size, including some twenty large 10-driver types nearly 20 mallets, besides a lot of powerful 2-8-0's. Well maintained, and usable with oil or coal as fuel, this power reserve was probably the fundamental reason why the system now has 409 miles of 127 pound rail north of De Queen and 111 miles of 112 lb. rail South of that point, making it one of the country's smoothest roadbeds for any type of existing or future power, for any kind of speed. Despite excessive curvature, the 302 mile mountain section can handle fast trains, with speeds up to 75 miles per hour permissible in most places. There is no limit on the flat country.

All factors considered, it is obvious that President Deramus went into Diesel for his Ozark bottleneck with his eyes wide open. You don't abandon steam operation in a land of oil and coal and plenty of pure boiler water, unless the figures show up in favor of Diesel.

It can easily be visualized from the brief study of the overall economics of the KCS Lines, together with a glance at the topography of the Ozark section of the line, that this busy, compact little system, with few unprofitable oranches and a strategic middle route, lends itself to long-range planning, even if the preponderance of cotton, petroleum products and forest products traffic does change over into something else. President Deramus has evidently been thinking hard about centralized traffic control, but came up with exactly the



Profile of the "B" unit.

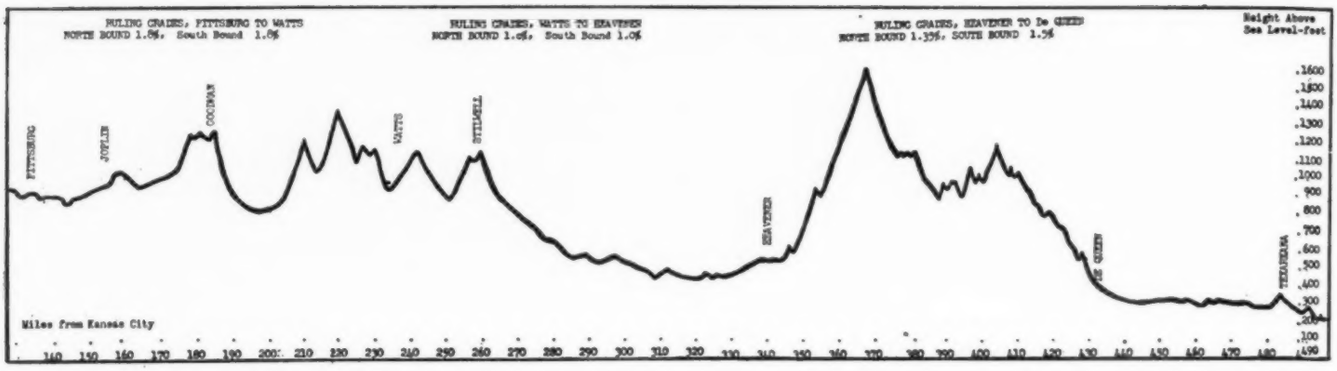
opposite conclusions when compared with other systems! This railroad of his, like most others, has short passing tracks and comparatively little automatic block. Three years ago, when everybody woke up to the hauling capacity of Diesel, the chorus of "CTC and Diesel" went up everywhere. The KCS has come up with an apparently unique answer: Why install CTC if Diesels will reduce the traffic over the bottleneck? Instead of expensive CTC and Diesel the scheme on the KCS is to utilize Diesel on an all-out basis and save on costly signalling! Run as few, as heavy and as fast trains per 24 hours as you can!

The first great question arose when the F.-M. 8000 hp. Diesel went to work was: How about drawbars? This was a superfluous question—it isn't the starting tractive effort that was needed, that gentle, ultra-fine amplydine control is easy on drawbars, but also gives sustained pulling power at speeds from 20 to 25 mph. Secondly, how about dynamic braking? Superfluous waste of $44,000 extra for this feature, says KCS, what have we got good airbrakes for? Third, how many steam locomotives will this single $750,000 road monster save? This question is answered by the most startling piece of railroad experience-history in 120 years, both in the U.S.A. and abroad: Careful calculations by the KCS motive power department reveal that not five or six but twenty-four steam locomotives of the selected inventory of the line can be eliminated by one single Fairbanks-Morse 8000 hp. Diesel freighter! Will the Smithsonian Institution or the AAR kindly take note! In this 302 mile operation with steam, heretofore shorter freight trains were hauled over various sections by 2-8-8-0 mallets or J class (Santa Fe) 2-10-4's, assisted over the 1.8% peak grades with assorted helpers. On light days perhaps the 2-80's would be used. Reduced to the same gross ton miles per train hours, and within reasonably close time over the 302 mile 3-Division route, the following averaged steam locomotive usage would be required: 8/2-8-8-0 mallets (both simple or compound—they have each); 6 class J/2-10-4's; 7 E.4 class 2-8-0's; 2-E.3 class 2-8-0's and 1 H class 4-6-2. 24 steam locomotives in all! These 24 locomotives would cost roughly three times the capital investment of one so-called "expensive" Diesel!

The F.-M. monster has 70/17 gear ratio, delivering a sustained rated output of 15.5 miles per hour of 163,920 lbs. drawbar pull (twice the Union Pacific's big boy output); weighs 1,355,-000 lbs. fully loaded, 928,000 lbs. of which are on driving axles, and loaded with 6600 gallons of fuel, 1440 gallons of lube oil, 1960 gallons of cooling water and 100 cubic feet of sand. Starting tractive effort is 232,000 lbs. if the engineer wants to pull drawbars! Maximum speed is 68 miles per hour. It is equipped for freight only, with no heating boilers or train signals and the boiler water tanks are filled with concrete ballast. Incidentally, this writer believes that good old F.-M. is about to steal a march on the U. S. Diesel industry, for this identical cab arrangement could hold a 3000 hp. OP Diesel and with 6 traction motors, become another "world's first," but don't mention it to a soul—this is just our hunch! Ultra fine regulation of the entire power plant is carried out in detail. The amplydine control system makes each of the four 2000 hp. OP Diesels respond, up or down, instantly, without overrunning the governor setting; cooling water circuits and radiators have full automatic electropneumatic control. Transition is automatic, with one jerky spot on the way down, being noted. A unique feature of this locomotive in line with the company's obvious belief that, for the present, CTC is not necessary, and that is the ingenious inductive-shortwave radio installation in the two end operators' cabs. By this compact system, and long elevated single wire aerials elevated atop the forward ends of the cabs, inductive radio communication is maintained between the engineer and conductor and the dispatcher.

The best way to visualize the KCS operation is to ride from Pittsburg to De Queen, 302 miles on one of these typical fast through freights from Kansas City to the Gulf of Mexico. Steam power brings tonnage down from Kansas City and it is made up in the big Pittsburg yards for through movement to Port Arthur, Texas, or New Orleans, or vice versa. Across the rough stretch south of Pittsburg has long been the chief operating problem of the KCS, which is otherwise a flat-country railroad. The sharp rise in war traffic plus demand for more speed, made steam operation on the Pittsburg-De Queen section a tedious, slow process, with frequent delays on sidings and limitation of the length of trains due to short sidings in territory where extensions to 100 or 125 car lengths would cost much time and money. The final answer came in speeding up all movements over this area, with bigger and smoother power. Diesel was the natural choice. Then came the question as to what size Diesel? The 8000 hp. Super Duper Fairbanks-Morse seemed to be the answer, what with calculations showing that a train of from 75 to 100 cars each way daily, across this stretch, would move the high-value, fast through freight that is competitive with other systems. The figures showed that a single larger size Diesel than ever before tried, would make one round trip daily—better than 600 miles, and do the entire job without helper service! The swift outgrowth of this plan was the decision to abandon steam almost 100% in this whole territory, and move all freight and passenger traffic through it with Diesel power, the big F-M being the leadoff motive power unit for this important, rather unique Dieselization venture.

So, our train is ready to go just before noon, from Pittsburg, running as Extra 60 with 55 loads and 40 empties, 4728 tons. All things being equal, the run of 302 miles is expected to take from 10 to 12 hours, depending on meets and delays in setting out and picking up cars at two points. The Southern Belle arrives on



Profile of the Kansas City Southern Lines between Pittsburg and Texarkana. Balance of the lines are fairly level.

time and we clear right behind this crack, spiffy little Diesel streamliner that takes Kansans to the Mardi Gras at New Orleans and the Gulf folks Northward in Summer to cool off. Lon Newcomer is engineer, a longtime KCS veteran, and C. E. Abercrombie, fireman. W. C. Dalton is travelling engineer from Shreveport and C. J. Durben, Fairbanks-Morse technician is along to take note of the bugs, loose nuts and bolts and watch how the machine performs, so his bosses up at Beloit can turn out bigger and finer Diesels in the future. There is so much room in this big 4-unit Diesel, what with compactness of the OP Diesel and lack of heating boiler facilities, that the company is considering selling tourist tickets for 100 mile sightseeing trips for the rubberneckers and Diesel fans! Out of Pittsburg station, there are 5 bad grade crossings of other railroads, necessitating a full stop at three of them. The remarkable smoothness of acceleration of this 95 car train is amazing. A light Pacific passenger steamer with a 7 car local train couldn't start smoother or faster. It took exactly 3½ minutes from the last dead stop in Pittsburg to reach 22 miles per hour with a 4700 ton train! The fingertip sensitivity of the amplydine control permits graceful, non-slipping starts, so smooth the conductor, back in the caboose, rarely breaks his leg or scalps himself from slack-action, even if the engineer feels cranky that trip. A rare thing with mile-long trains.

Practical railroaders observe that 90% of the drawbar failures and busted knuckles could be eliminated with smooth Diesel acceleration. The whole trouble is that too many railroad presidents are trying to run freight equipment built in 1920, by the standards of that time, on the fast, heavy standards of 1947, with steam power that simply cannot deliver the goods. So the trains break in two and sit on the siding, while the accounting department wrings its hands and counts the company's losses at about $11 per freight train hour. 30 year old freight equipment can be made to perform smoothly and economically for years to come, with Diesel, but not with steam, they say.

Including an operating stop at Joplin, while a cuckoo Rock Island local freight blocks the line and a stop at Neosho, while an equally cuckoo switch engine Bozo scares H— out of the engineer with his illegal antics on a sidetrack with a blind switch, we make Neosho, Mo., in 1 hour and 48 minutes, not bad for 48 miles and 7 full stops.

We arrive at Watts, Oklahoma, at 4:15, and due to very poor planning on the part of the dispatcher, we sit on the main line for 45 minutes, while the new crew, consisting of Guy Atkins, engineer, L. E. Roscoe, fireman take over, the other gentlemen having earned a nice day's pay for 4 hours work in the luxury of the big Diesel!

The run from Watts to Heavener is generally down light grade with a few sags, along winding creeks and across little plateaus. What was once a magnificent forest, is slowly growing back to pulpwood and the farther south we get, into Oklahoma, the more we are lost in the Land of Lum & Abner, where people wear shoes only to look nice and they do their Spring plowing in January and their harvest in June and swelter in the hot, dry sun all summer. They both nod and wave to the Diesel as we pass down to the foot of the Ouachita Mountains for the last big climb before reaching the vast coastal plains of the Gulf country.

An interesting operation was noted, halfway up the Rich Mountain Hill, where a passenger meet was scheduled. We arrived at Heavener at 8:25 and left at 9:15, after a big breakup of the train and raising our tonnage to 4605, with 96 cars. With no block signals, the entire operation is by train orders, supplemented by radio orders. We stopped this long train on a hill, with three curves, to let the passenger "saw" by —our train was so long we had to pull past the entrance switch before the passenger could clear. Without a slip or a jerk, we made this gentle move, stopped to give the rear brakie time to complete his chores, started up the 1.8% grade smoothly and reached 18 miles per hour, with nary a hitch! With steam operation, including helpers, three engine crews and 3 conductors would have gotten the willies on this manouver in the pitch black of night, up in the Ouachita Mountains—'way down in Arkansaw. Engineer Holcomb and Fireman Franklin pulled the big drag into De Queen in 10 minutes short of 12 hours, an unusually excellent run, considering almost 3½ hours of wasted time lost for orders and another hour lost in setting out cars and stopping for crossings.

Refuelling is done only at Pittsburg for the entire 604 mile trip and all delay time with Diesels idling. This trip was run off so smoothly that the absence of lube, water, air, drawbar or mechanical failures was conspicuous by their total absence. At all ranges of speed the F-M opposed piston Diesels ran as smooth as sewing machines, with no criticals anywhere in the operating range. The noisiest things in the cabs are the traction motor blowers, with their high pitched whines. It occurs to us, from watching this operation, that perhaps a better freight characteristic could be developed by putting smaller traction motors on all six axles and eliminate entirely the idlers. Just a thought gleaned while watching it behave on sharp curves, under full load at speeds below 18 miles per hour. One interesting thing seemed to mark the OP engine—the more heavily it is loaded the cooler it runs and the more beautifully it behaves. Perhaps some railroader will try to run it non-stop from Kansas City to New Orleans, wide open, some day just to see how many gtm. per th. the Diesels really will turn out!

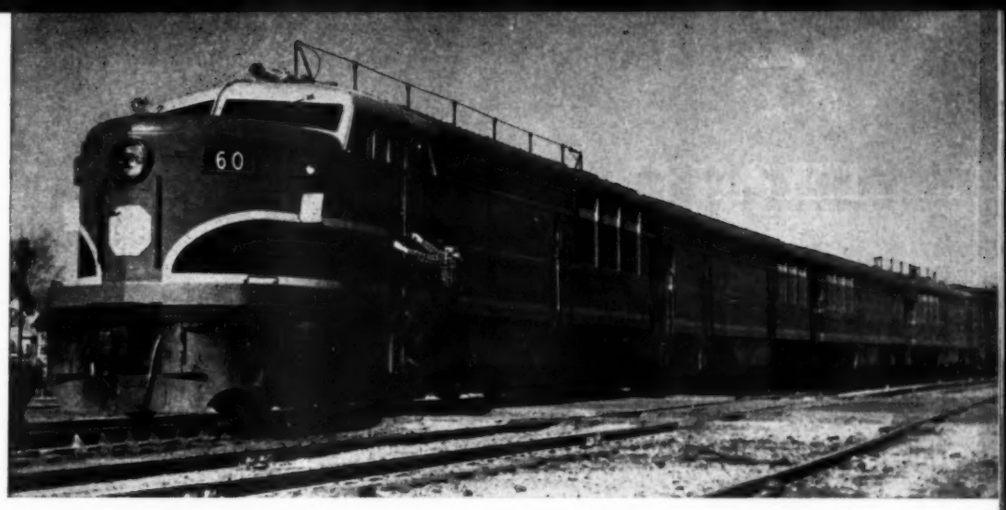
So, for a few years, at least, KCS will be spared a $10,000,000 investment in block signals and/or CTC, because of its Diesel operation. Freights 77 and 88, to and from Port Arthur and New Orleans and 41 and 42 from Kansas City to Shreveport, normally get the D 60 F.-M. assigned to it. Later, when the Diesel pool is rounded out, and if traffic declines to a point where it means unnecessary delays in accumulating sufficient tonnage to make a load big enough for the 8000 hp. F.-M. Diesel, the locomotive can be simply split into two 4000 A plus B locomotives, tack on another A unit, and presto!—KCS Lines have two 6000 hp. Diesels to do identically the same job with 70 car freights instead of 95 car whoppers. In this direction, Fairbanks-Morse delivered two 2000 hp. A units to KCS Lines January 31, 1947, just to keep our record straight!

During the short December, 1946, period, the big Diesel averaged 78.5 cars per train and 3831 tons, the heaviest train being the 5473 ton, 107 car train, December 11, that made the record of 124,287 ton miles per train hour. The 8000 hp. F.-M. Diesel burns about 8 gallons of fuel per mile, at 5 cents per gallon cost to the engine. Two simple, modern mallets which would be required all the way across on this kind of a train, would burn 35 gallons of black oil per mile, at a cost of 3.5 cents per gallon! So you have a fuel bill of about $1.23 per mile for slow steam operation, not including helpers on the 10 hills; as against 40 cents per mile with the Diesel. One million locomotive miles of the Fairbanks-Morse Diesel, at this comparative saving would pay for its engine original cost . . . and at the rate of 15,000 miles per month, it would only take about six years to save its investment cost in the fuel savings alone!

So America scraps steam locomotives and "goes Diesel" at a frantic pace in 1947. The figures, everywhere, throughout 60 railroad systems, simply do not lie.

The January 1947 figures, just released on the big F.-M. loco are interesting: Miles made, 13,420. Gross ton miles, 53,819,432. Average train load, 4010 tons. Average train miles per hour, 26.9. Gross ton miles per freight train hour, 107,711. Loaded and empty cars per train, 79.2. Average miles per locomotive day, 432.9.

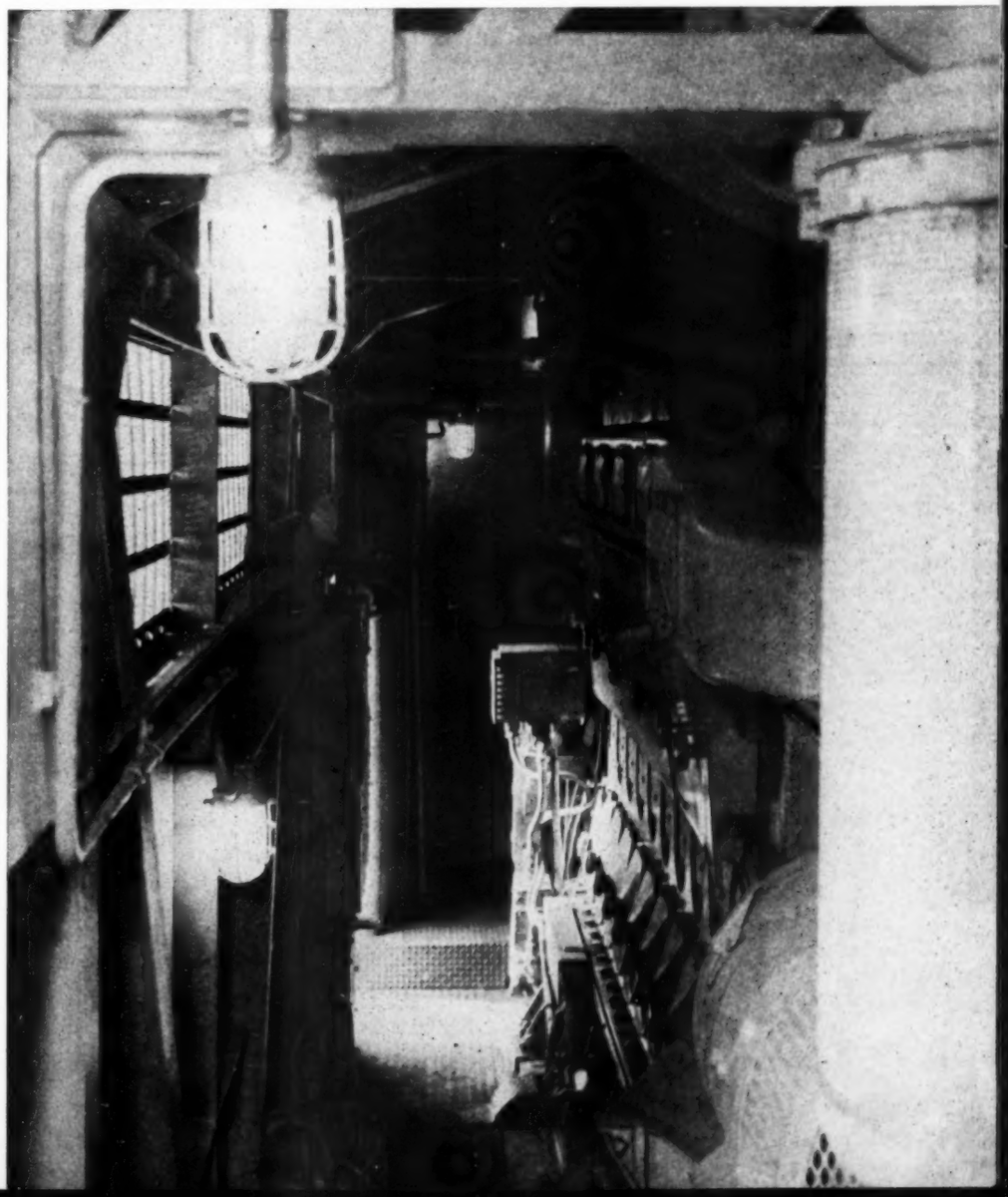
The Diesel inventory on the KCS system is as follows: Five 2000 hp. passenger units on Trains 1, 2, 15 and 16, with two 3000 hp. passenger units on order to Dieselize both



World's first 8000 hp. Diesel locomotive is equipped with inductive radio (note antenna).

trains from Kansas City to the Gulf. One 8000 hp. F.-M. and two 2000 hp. F.-M.'s just delivered; two 6000 EMD F3 for freight service and three 6000 EMD f-3 to come. Five 1000 hp. EMD switchers are now in service and one Baldwin 660 hp. switcher, with twelve 1,000 EMD and four 1000 Alco switchers on order. All will be maintained at a new shop at Pittsburg, Kansas, and the present and new road power will permit 100% Dieselization of through passenger service, with some schedule tightening and 100% Diesel freight operation between Pittsburg and De Queen. The KCS motive power organization operates under F. H. Hooper, general manager at Kansas City; Wm. Nelson, general mechanical assistant to Mr. Hooper; W. N. Deramus III, assistant to Mr. Hooper; J. M. Pierce, superintendent of machinery, and Roy Skidmore, superintendent of shops at Pittsburg.

The "slim," F-M opposed-piston Diesel (right) leaves ample room in the cab.



GIANT DAIRYLAND POWER COOPERATIVE

By F. D. BLANCH*

THE Dairyland Power Cooperative is one of the largest cooperative ventures in the world. As of November 1, 1946, it was furnishing electric utility service to a membership of 47,198, a membership which will increase rapidly as soon as facilities for serving them can be provided. It provides generating and transmission facilities for 22 Distribution Cooperatives who purchase and distribute the electric energy to their individual members.

This Cooperative had its origin in the formation of the Wisconsin Power Cooperative in 1937. The first power plant was built at Chippewa Falls, Wisc., and went into service in early 1938 serving 11 counties in that area. Shortly after, the Tri-State Power Cooperative was organized in Southwestern Wisconsin and built a steam generating plant at Genoa. These two power cooperatives were then merged to form the Dairyland Power Cooperative which now serves a total of 22 Distribution Cooperatives in Wisconsin, Minnesota, Iowa and Illinois.

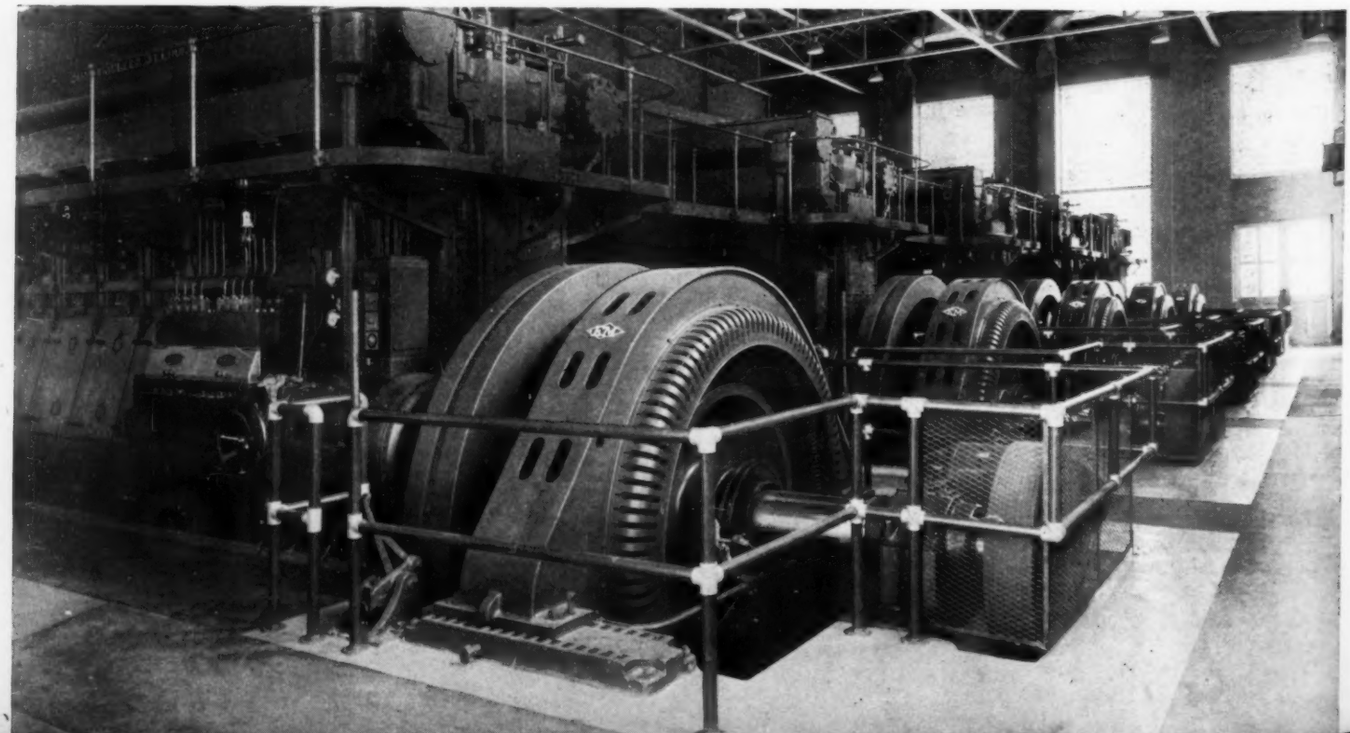
The original installation at Chippewa Falls consisted of three 700 kw. Diesel generating units. The capacity of this plant has been increased by the installation of three additional 700 kw. Diesel units. The steam plant at Genoa had an initial capacity of 6,000 kw. consisting of two 3,000 kw. units, and this has been increased to a total of 14,000 kw. by the addition of two 4,000 kw. units.

A new power plant has just been completed at Baldwin, Wisc., the generating equipment consisting of two 2,500 kw. Diesel engine driven units. The first unit in this plant was put on the line on October 28th, and the second unit a few days later.

To provide for the rapidly growing requirements, an additional steam plant is under construction at Alma, Wisc. This plant will provide 30,000 kw. in two 15,000 units. There is also contemplated the building of a hydroplant on the Flandreau River in the vicinity of Ladysmith, Wisc., which will provide approximately 12,000 kw. Additional Diesel generating plants at various points in the system are also under consideration.

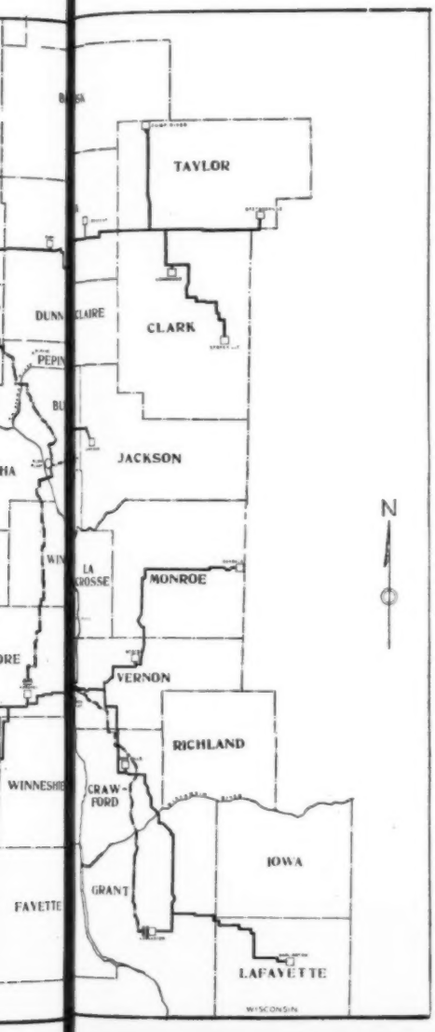
The line diagram on the accompanying map shows the high voltage distribution lines now built and being built. The solid black lines represent the 33,000 volt transmission system now in use. The broken black lines represent 69,000 volt transmission lines now being built which will radiate from the new Alma steam station to various points where the power from this station will be fed into the existing 33,000 volt system. At the present time there are about 800 miles of 33,000 volt line in opera-

Diesel plant at Chippewa Falls, Wisconsin, with a 4200 kw. capacity. Dairyland Cooperative had had its beginnings in this plant.



Minneapolis District Manager, Electric Machinery Co.

VE ADDS MORE DIESEL HORSEPOWER



tion and there will be about 125 miles of 69,000 volt lines. As of November 1st the distribution cooperatives had in operation approximately 16,750 miles of secondary distribution for serving their membership.

That the farms served by Rural Electrification projects are really making use of electric energy in lightening the burdens of farm work is shown by the fact that the members of the Dairyland Cooperative used during the month of October nearly 7,500,000 kilowatt hours of electric energy, or approximately 160 kilowatt hours per member. No one is able to predict with any accuracy the ultimate use of electricity on the farm. It has already far exceeded both in number of users and amount of energy per user the most optimistic estimate of the original sponsors of Rural Electrification. That the Dairyland system may eventually serve 75,000 or even 100,000 farms and other users in rural communities is certainly not to be considered an impossibility.

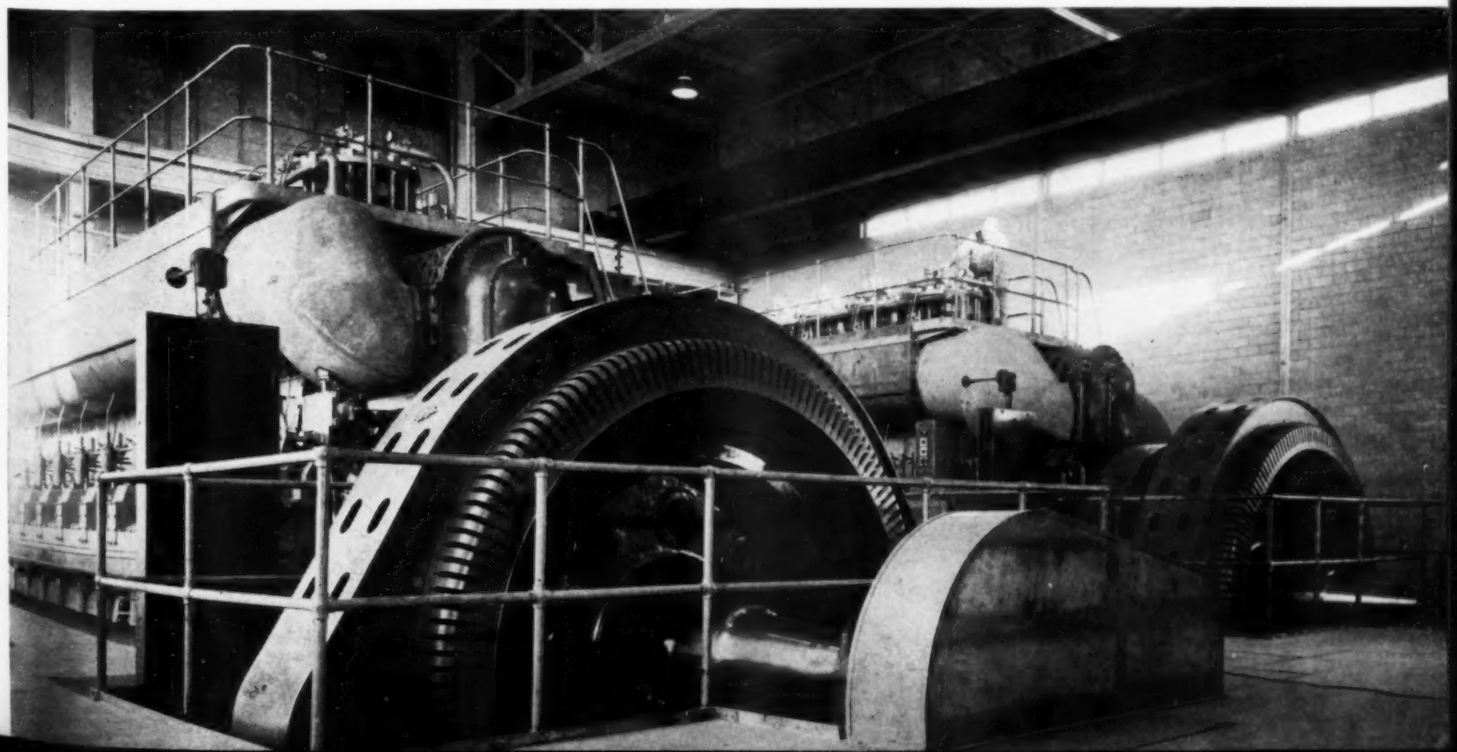
The headquarters of this far reaching cooperative is centrally located at LaCrosse, Wisc. Its president is Mr. E. J. Stoneman of Plattville, Wisc., who was formerly president of the National Rural Electric Cooperative Association. Mr. C. W. Eppard is General Manager. Other officers and members of the Board of Directors are chosen from the various distribution cooperatives located in all four States which the cooperative serves. A Supervisory staff of electrical and mechanical engineers, accountants, plant superintendents and transmission line foremen is maintained to keep the system in smooth working order.

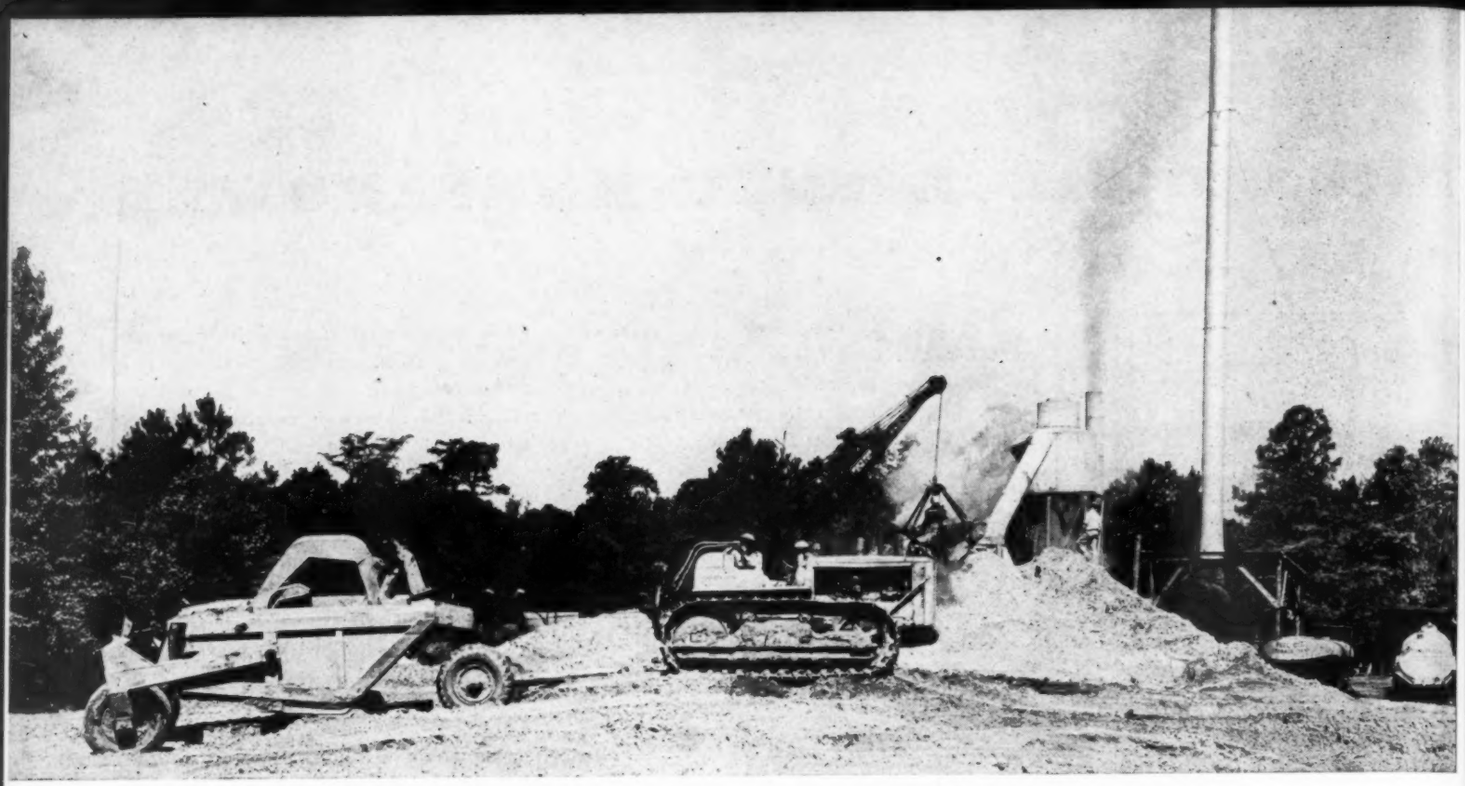
The new installation at Baldwin, Wisconsin, with its two 3600 hp. Nordberg Diesels and Electric Machinery Company's generating equipment is one of the most modern plants in the United States and is by far the most imposing structure in the vicinity of Baldwin with its population of a scant 900. However, Baldwin's citizens claiming to constitute "the biggest little town in Wisconsin" now have the opportunity to make this claim good with the help of low cost power.

The Dairyland Cooperative recently installed two way radio communication between plants in order to provide better coordination in plant operation and line crew operations. This method of communication prevents annoying and even dangerous delays and makes for efficient operation.

The cooperative's 1945 financial statement gives an approximate total value of plant properties as $11,780,874.43 upon completion of present construction. It also includes a tax item of $28,941.11 for a twelve month period which tends to disprove claims that rural electric cooperatives do not pay taxes.

Dairyland's newest plant at Baldwin, Wisconsin, with two 3600 hp. Nordberg Diesels developing total of 5000 kw.

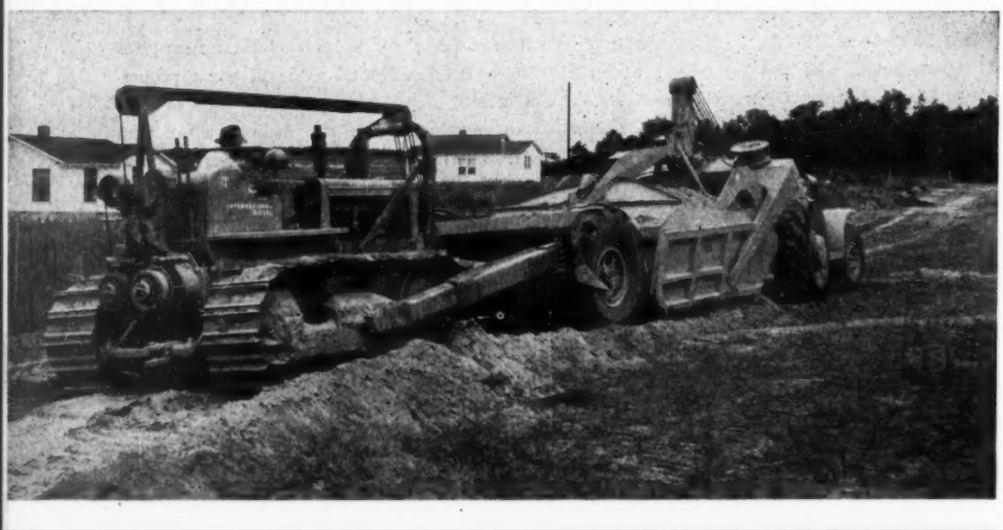




Asphalt plant above produced 30,000 tons during past year. International Diesels operate plant while in foreground is seen International Diesel tractor and 10 yd. Bucyrus Erie scraper.

CAROLINA CONSTRUCTION DIESELS

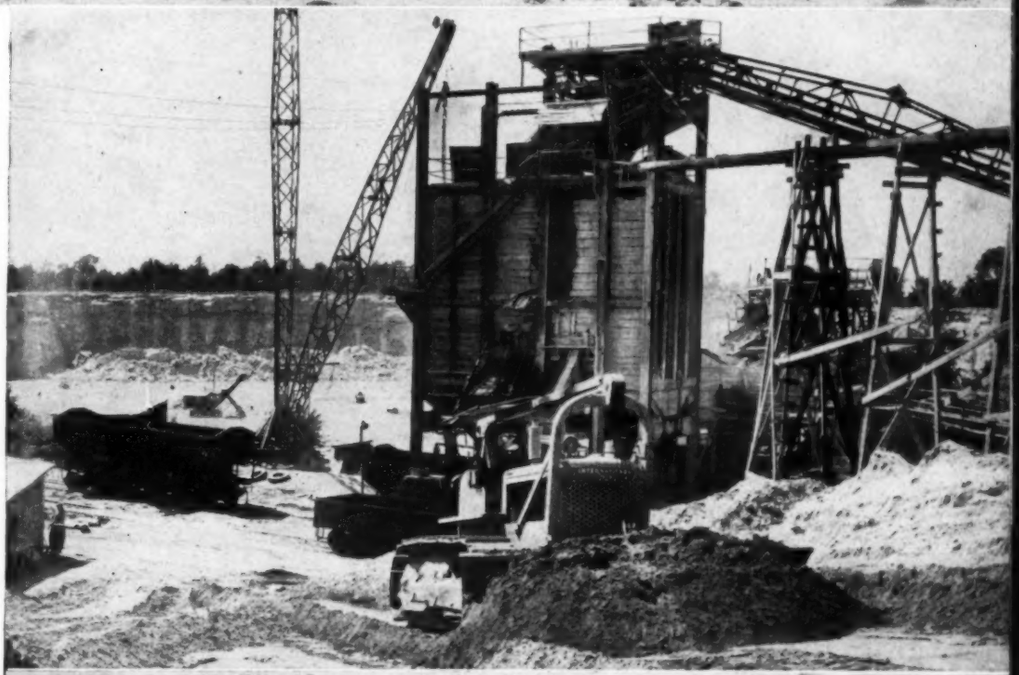
N. K. Dickerson, Munroe, N. C., contractor picks up fill for new highway with a Diesel tractor and cable dozer.



THE North Carolina Highway Department during the past year has contracted for various kinds of work on some 1500 miles of highways. Much of the work has been the elimination of curves, by-passing of cities and other improvements to promote a smoother flow of traffic and safer highway conditions. The largest single item was bituminous treatment for 420.49 miles of road. The place that Diesels have taken in this reconstruction program is most important. Diesels, combined with the latest in earthmoving equipment, make short work of most of the projects. Diesels in the rock and asphalt industries aided greatly in this program by supplying the raw materials the roadbuilders needed. Good roads are essential for North Carolina for the bulk of her goods are carried by truck.

Granite quarry northeast of Raleigh is source of stone for new Carolina roads. Here International Diesel handles huge rock chunks after dynamite blast. Quarry is operated by the Bryon Rock and Sand Co. of Raleigh.

Ingenious road packer seen in top illustration is loaded with sand to desired weight. It will carry ten tons on its ten tires. The packer is being drawn by a Diesel wheel tractor. Both are owned by the N. L. Teer Co. of Durham, which handled many road contracts in the northern part of the state during the past season.

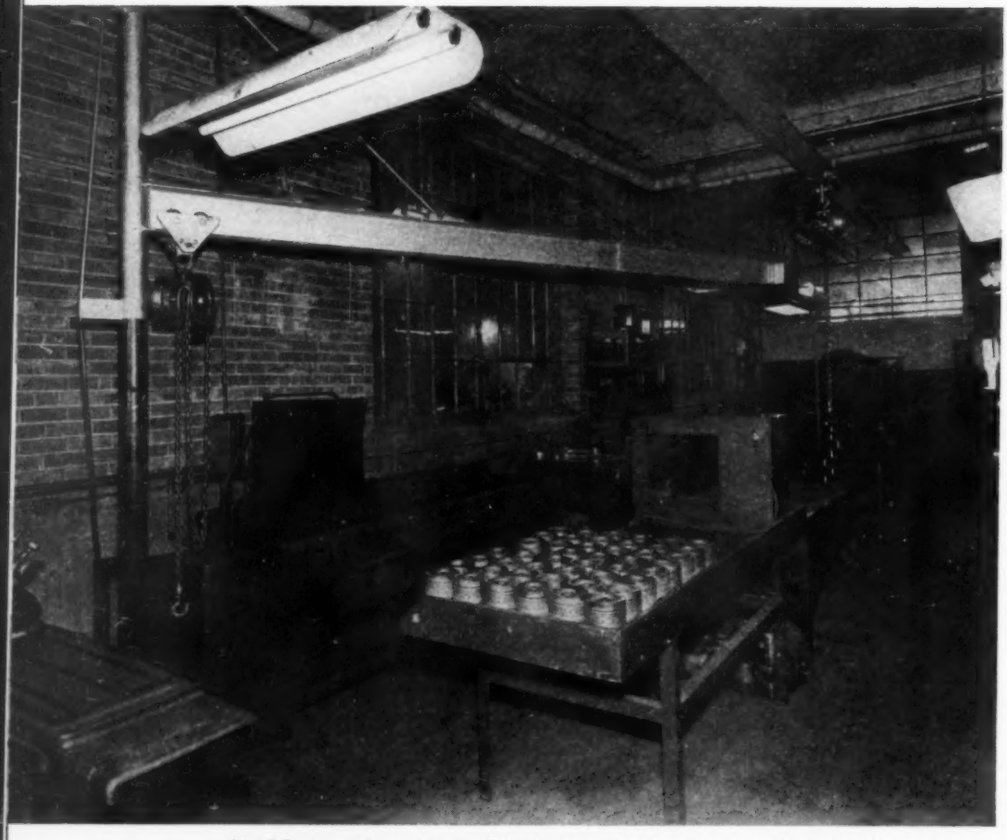


(Right) The Bryan Rock and Sand Company of Raleigh, producer of sand, gravel, and crushed stone, operates four quarries and four sand and gravel plants in various places in the northern part of North Carolina. Big Diesel Crawler tractors play an important role in moving huge quantities of material at these plants and quarries. Illustration shows Diesel tractor with Heil cable dozer is shown near the big crushing plant at the top level moving screenings up on a big stock pile. These screenings are used as top dressing on bituminous surfaces and also in the manufacture of cement blocks. The crushing plant which consists of a 48 by 60 primary jaw crusher, two 16-inch gyratory crushers and a fine crusher has a capacity of 3000 to 35,000 tons a day.

Illustration (bottom, right) shows asphalt mixing plant operated by the Towles-Cline Construction Company of Wilmington, North Carolina near Kerr, 40 miles northwest of Wilmington to serve various road-improvement jobs. Two International Diesels operate this plant. One of these is seen driving the mixing drum. During the past season the plant produced over 30,000 tons of asphalt mix for North Carolina highways.

EFFICIENT DIESEL TRUCK MAINTENANCE

By FRED M. BURT



Special connecting rod reconditioning bench. Also shown are boring tools.

Liquid type Ferroscope used to inspect engine parts for flaws and cracks.

THE maintenance system employed today by Pacific Intermountain Express (P.I.E.) to keep its large fleet of heavy duty Diesel trucks in top operating condition, owes its outstanding success to the elimination of guess work. This program was started when the company came under the present management about five years ago. With company and maintenance headquarters in Salt Lake City, the Eastern Division operates from Denver through Kansas City to St. Louis and Chicago. The Western Division runs through to the Pacific coast.

Peterbilt tractors have been adopted as standard with 150 and 200 hp. Cummins engines. Through a complete record system, the service work is figured ahead of time, as follows: from the dispatcher comes information as to where a certain truck is going and its total mileage on its return to the main shop in Salt Lake City. When the unit is dispatched from Salt Lake City the clerk adds the mileage it will cover to the mileage already on the records, and the Truck Inspection Sheet is made out for the service work to be done on its return. This sheet lists the checks required after the specified mileage has been put on the truck. On the back of the T.I.S. the service work to be done is listed for each mileage group. There is a substantial supply of spares for every Diesel engine requirement. They are rebuilt on a production-line basis. Trucks that have been coming in for engine frame overhauls at 70,000 miles will be held off for 80,000 miles as the records show that this will be enough.

The first step in the frame overhaul is to drop the pan and check the throws. If these show less than .004 in. wear then the engine is framed. If the crankshaft has more than .004 in. wear or a flat spot, the engine is pulled and replaced with a rebuilt engine. In a frame overhaul the sleeves, pistons, heads, and upper rockers are replaced, also the main bearing shells, if worn. The fuel pump and injectors are pulled and recalibrated, transmission covers are pulled and they are checked as are the differentials. The engine is then rebuilt using reconditioned parts.

After two or three frame overhauls the engine is completely rebuilt. In a complete rebuild-

ing job, the engine is removed from the truck. The engine is then completely dismantled and attached to a rubber-tired, four-wheeled wagon. Carried on the wagon to a steam rack, the parts, except block and crankshaft, are removed, steam cleaned leaving the heavier parts free for moving and cleaning.

Compressor, heads, starter, etc. are turned over to their respective benches and mechanics for re-conditioning. The block is put on the first of two special stands in an upside-down position. After the rebuilding has reached a certain point, the engine is transferred to another stand. While in the upside position, the block is checked for cracks and is cleaned of scale, rust and carbon. Then it is checked for alignment by placing a mandrel, machined .001 smaller than the bore for the main bearing shells, the main bearing caps are then pulled with a pull of 310 foot pounds or the angle setting, whichever is required. If the mandrel can be removed the block is not warped. If it cannot be removed it is blued to see where the misalignment may be.

If the block requires welding and machine work the block is discarded in favor of a new one. Camshaft bushings are replaced with new ones and a camshaft that has been checked throughly is installed. The block is turned over and sleeves are installed. Then the engine is laid on its side, pistons and connecting rods are installed and the engine is set upright. The lower cam followers are then installed, push rods are put in place and the engine is then ready for timing.

Dial indicators are used with one set over the piston and the other over the injector push rod. Starting with number one cylinder, the lowest point of the injector lobe on the camshaft is located and the dial indicator is set at zero. Then number one piston is brought up to top dead center and the dial indicator over the piston is set at zero. At this point the injector dial indicator should show from .089 to .091 lift. Next the engine is turned counter clock-wise .200 on the piston dial indicator, then clockwise .007, leaving the piston .193 below dead top center. At this point the injector dial indicator should read .055 to .056 lift. Then the engine is turned clock-wise to get maximum lift on the injector dial indicator which should be between .098 to .100. This procedure is repeated through all six cylinders in proper firing order 1-5-3-6-2-4. If 1 and 2, 3 and 4, or 5 and 6 lifts should be low they can be increased .002 to .003 by adding one lower cam follower gasket. This timing is for HB engines only.

Proper timing helps to accomplish complete combustion of the fuel and is a large factor in the prevention of smoke.

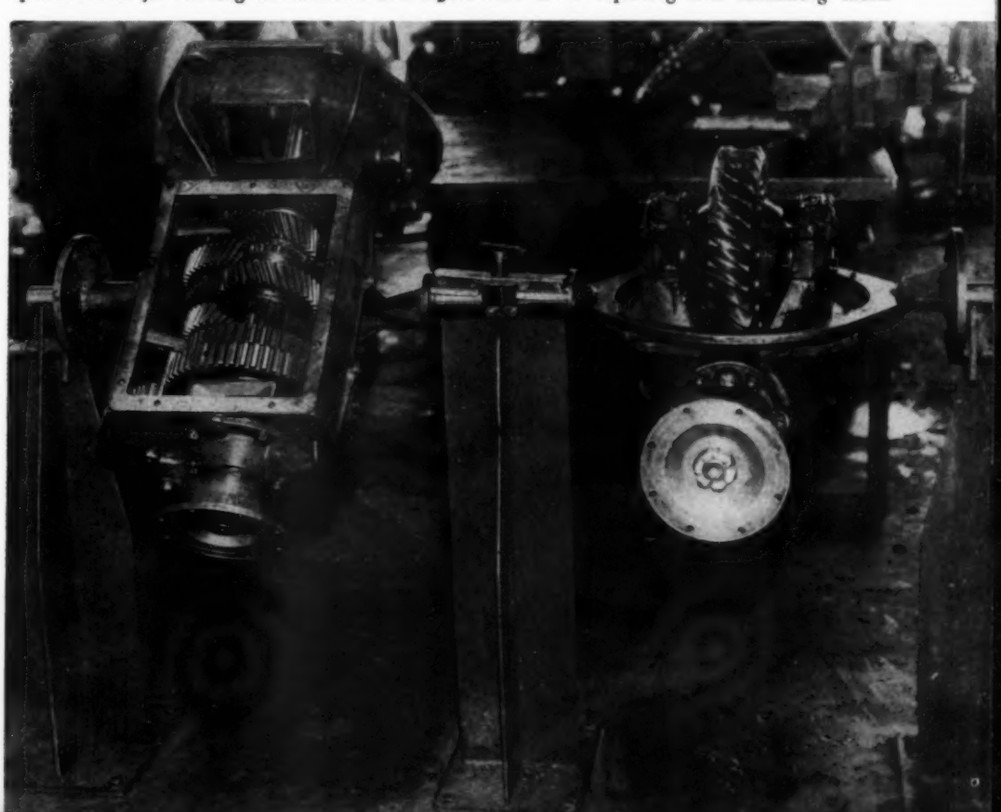
Crankshafts, camshafts, pistons and rods are run through the Ferroscope to check for cracks or flaws. Pistons, sleeves, etc., are blasted with walnut hulls for removal of rust, carbon, and scale. Rods are checked for being out of round on the throw or out of line.

The bushing is then pressed from the rod and a new semi-finished bushing is pressed in. Then the rod is taken to the boring bar to bore out this bushing to fit the wrist pin. The boring bar puts the two holes in perfect alignment and within a minus .005 in. of the exact distance of 12 inches recommended by factory specifications. The rods are balanced to within one quarter of an ounce of each other. Next the rods are put up in sets of six, stamped with set number and put in stock for future use. Pistons, after cleaning and Ferroscope checking, are balanced in sets of six, stamped with a set number and put in stock. Sleeves, after checking, are taken to the sleeve boring machine, which bores the sleeves to the oversizes, .020, .040, and .060. These are then matched in sets according to the bore, stamped with the bore size and placed in reserve stock. Heads are checked thoroughly for cracks and checks. All soft plugs are removed and the scale, rust and carbon is removed by blasting. Seats are checked and any worn, loose or cracked ones are replaced. Injector coppers are checked and if bad, replaced. Records and observations have proved that thoroughly cleaning parts of rust scale and carbon has eliminated most of the road failures.

Upper rocker cages are dismantled with the rockers being re-bushed if necessary. Worn shafts are sent out for chrome-plating. Oil holes are checked for free oil circulation, injector tips and the adjusting screw and nut also receive atention. Then assembly and into stock. The lower cam followers are dismantled with bushings and shafts checked. Pins and rollers are removed and the followers go to the welder where the pocket is built up with bronze. It is then placed on a special jig and bored out to a distance of .065 in. higher than when new. Pins and rollers are replaced, then assembly and to stock.

Next at the P-I-E designed and built injector check stand, the injectors are taken apart and cleaned, first in solvent, then in fuel oil. Cups are checked to be sure all holes are open. If any holes are oversize the cup is replaced. The former trouble of engines "making oil," was eliminated by doing the following. A 3/16 in. hole is drilled through the scavenger hole into the plunger shaft opening and a groove turned out around that shaft opening at the entrance of the hole. The breather hole on the scavenger line is plugged and the injector cap is notched for the engine oil to return from the plunger spring. The gasket is left out between the cap and body of the injector allowing the fuel oil to return to the pump, and the lubrication oil to return to the oil pan. This saves the dilution of engine oil and cuts down on excess smoke.

Special stands for holding transmissions and differentials while repairing and rebuilding them.



Then the injector is assembled and checked for operation. Three stalls are used to check the amount of leakage around the plunger shaft; the fourth to check the spray pattern. The machine's hydraulic pump maintains a fuel oil pressure of 2,000 psi. The injector is clamped into this stand and the oil is pumped at this 2000 lbs. pressure through the six openings in the cup and up around the shaft. This runs through a small piece of tubing and drips into a small CC test tube, which measures the leakage per minute. If the leakage around the plunger shaft exceeds 52 drops per minute or 4 CC's, the injector is sent to the Cummins factory for reconditioning. If less than 4 CC's it is put into a special rack built to hold and carry them till they are all checked. They are then put into sets of six with no more variation than 1 CC or 13 drops per set.

After checking for leakage, the injector is clamped on the fourth stand and the spray pattern checked for the proper fuel dispersion. This system of calibrating and checking the injectors insures the proper amount of fuel injection to facilitate more complete combustion with less smoke and carbon.

The P-I-E designed fuel pump checking stand consists of a five-hp. electric motor, variable speed pulleys, reserve fuel oil tank, two oil filters, twelve fuel supply tubes rebuilt to the specific needs, and a tachometer and counter for the rpm. The rack where the pump is bolted on can be turned by a crank to facilitate easy handling and installing of the pump.

At one time considerable trouble was caused by drivers trying to increase the zip in the engine by increasing the amount of fuel pumped. This ended in putting the pump out of calibration, damaging it and the rest of the engine. As a result, a locking system was devised. Through a hole cut in the side of the pump, the calibration was set with special tools. The setting was then locked and the hole sealed with a soft plug and stamped with a special stamp. The hole was so located that when the pump was on the truck, the truck frame made the hole inaccessible. This ended the troubles along that line.

When a pump is dismantled for the first time the oiling system is changed over from lubricating oil to a fuel oil lubrication. After the locking system is installed and the oiling system changed over, the pump is reassembled and put on the checking stand. Lines are connected, the pump is primed, started and run at idling speed until warmed up, then calibrating starts. On the HB pump it is speeded up to 1550 rpm. and then checked to see that it is pumping 32 CC every 500 revolutions. It is then checked for delivery every 100 rpm. until it reaches 1850 rpm.

On the NH pump the checking starts at 1550 rpm. and checked at every increase of 100 rpm. for delivery of 38 CC in 500 rpm. until it reaches the speed of 2100 rpm. After calibration they are sealed and placed in stock. This proper calibration is another factor in proper combustion and less smoke by assuring the delivery of the proper amount of fuel.

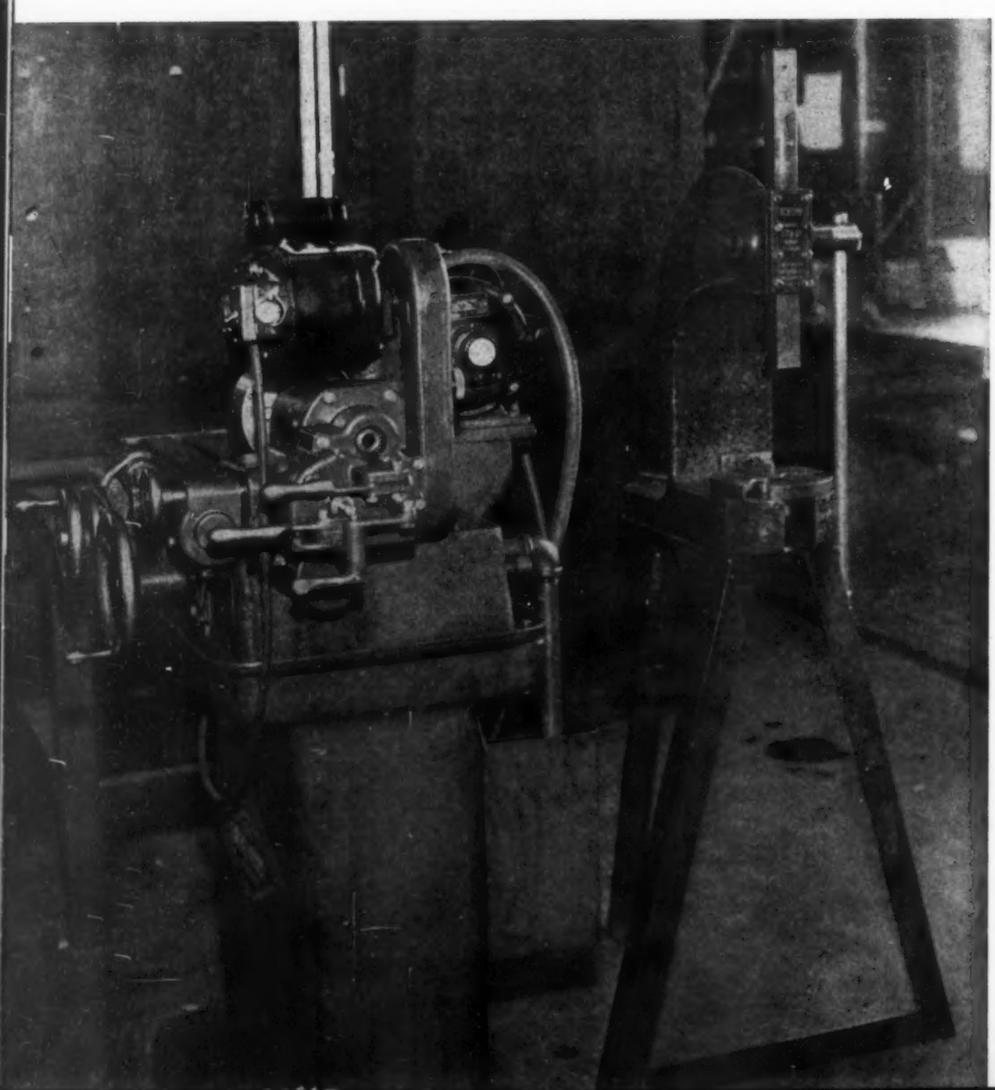
But returning again to specific engine detail—when the fleet consisted only of HB-150-hp. engines, complaints were numerous about the lack of power. Careful studies were made to devise ways and means to add extra power.

Knowing that the colder the air, the more oxygen content, it was decided to find out how to get cold air into the engine to provide a more complete combustion. It was found that the two six inch air cleaners used, starved the engine for want of adequate oxygen. Even three six inch cleaners did not provide quite enough. It was calculated that a little over a 12 sq. in. opening was needed. So two eight inch cleaners were installed on some tractors, and three six inch ones on others.

Then in order to obtain colder air, aluminum castings were designed to carry air from in front of the radiator to the cleaners. Before this change tests showed that in October, not a hot month, temperatures under the hood ran around 150 degrees F. Cummins information states that for every 10 degrees above 90 degrees it deducts 1% of the horsepower. Bringing air from in front of the radiator built up the horsepower around 6%, a very valuable addition in pulling grades.

Much work has been done by P-I-E of late, on noise control. Every usable muffler designed plus some designed by P-I-E were tried. One muffler in particular does a very good job of muffling the exhaust without any back pressure, but it will not stand up against the intense heat running up to 1400°F. Ordinary metals won't take this for long so P-I-E is now looking into the properties of Inconel, believing that its use will provide the proper answer.

Valve refacer and piston grinder. Small press used for replacing bushings and straightening small shafts.

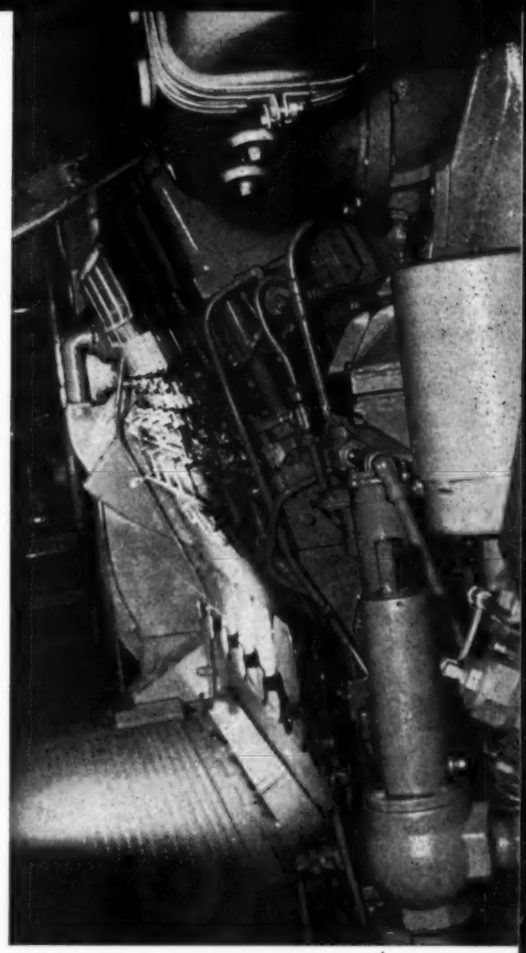


CONTROLLING THE ALCO DIESEL LOCOMOTIVE

A COMBINATION electric hydraulic control system for the new Alco Diesel road locomotive contributes greatly to its outstanding success. The new Alco-General Electric locomotive is a 3-unit, 6000 hp. job with Diesel-electric drive. Located in each of the three units is an Alco, 16 cylinder, turbosupercharged, four cycle, V-type Diesel rated at 2000 hp. at 1000 rpm. which drives a General Electric generator which in turn supplies current to the four traction motors.

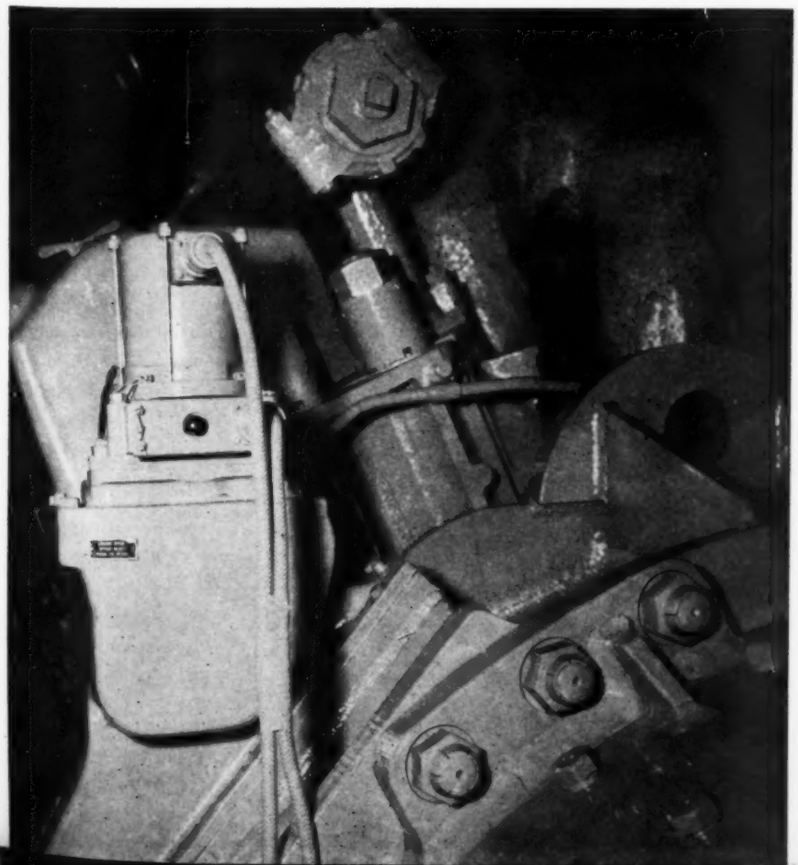
The control system begins with the engine governor and the tachometer generator both of which are mounted on the engine. The tachometer generator is driven by the Diesel and hence its electric output is directly proportional to the speed of the engine. The governor, energized by the tachometer generator, then acts to control the fuel pump racks of the Diesel. It also controls the generator demand through the amplidyne exciter. Such an arrangement permits the Diesel to operate at a constant speed despite fluctuations of load. If, however, the load becomes too great, the governor automatically unloads the generator, thus permitting the engine to recover rated speed. The amplidyne exciter, mounted on the generator and connected into the shunt field winding of the generator, holds the key to this whole control system. For it is this piece of equipment which increases and decreases the generator output by changing the current supplied the field winding of the generator. The amplidyne however does something which other exciters can not do in that it utilizes the exceptionally low control current which is amplified as much as 10,000 times to accomplish generator control.

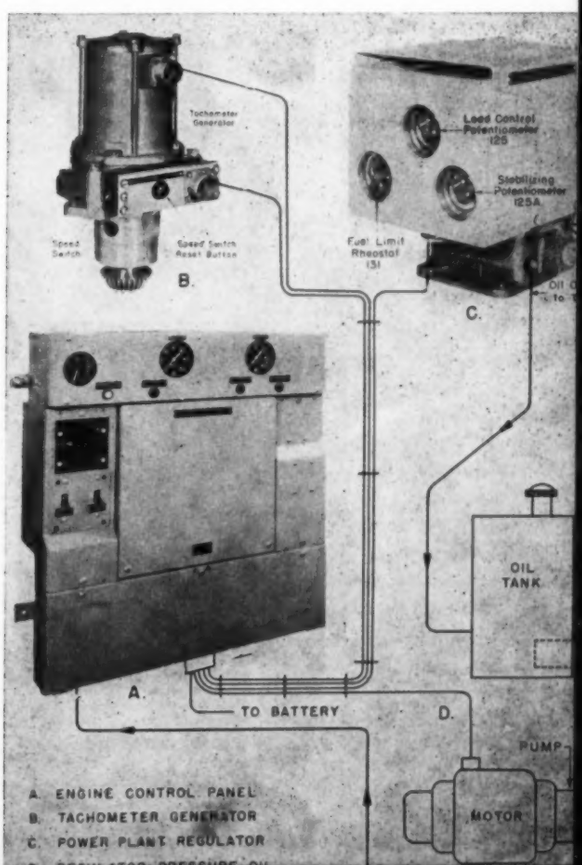
Another interesting feature of the control system is the provision made for cutting engine units in and out of the line in cases where it is desirable to do so. In this way an engine may be broken in during the operation of a multiple unit locomotive without fear of burning out the unit during full speed operation. This is accomplished by turning the engine control switch, located in the engine room, to one of the positions below the run position, thus lowering the speed and output of that particular unit. When the control switch is placed on run the engineer in the cab takes over control with his throttle.



Engine room, looking forward, Alco Diesel at right.

Tachometer generator, integral part of the electric-hydraulic control system for the Diesel-electric drive seen mounted on forward end of engine. (Lower right) Schematic layout of control system showing electric and hydraulic connections.



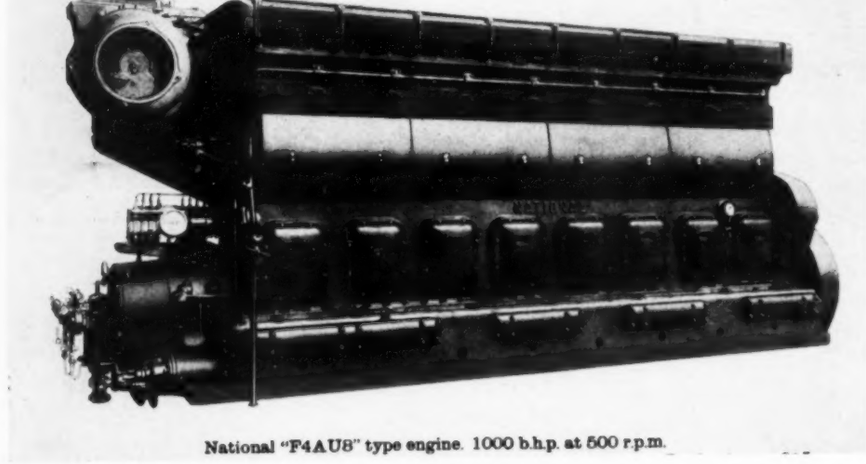


DIESEL PROGRESS IN GREAT BRITAIN

By HAMISH FERGUSON

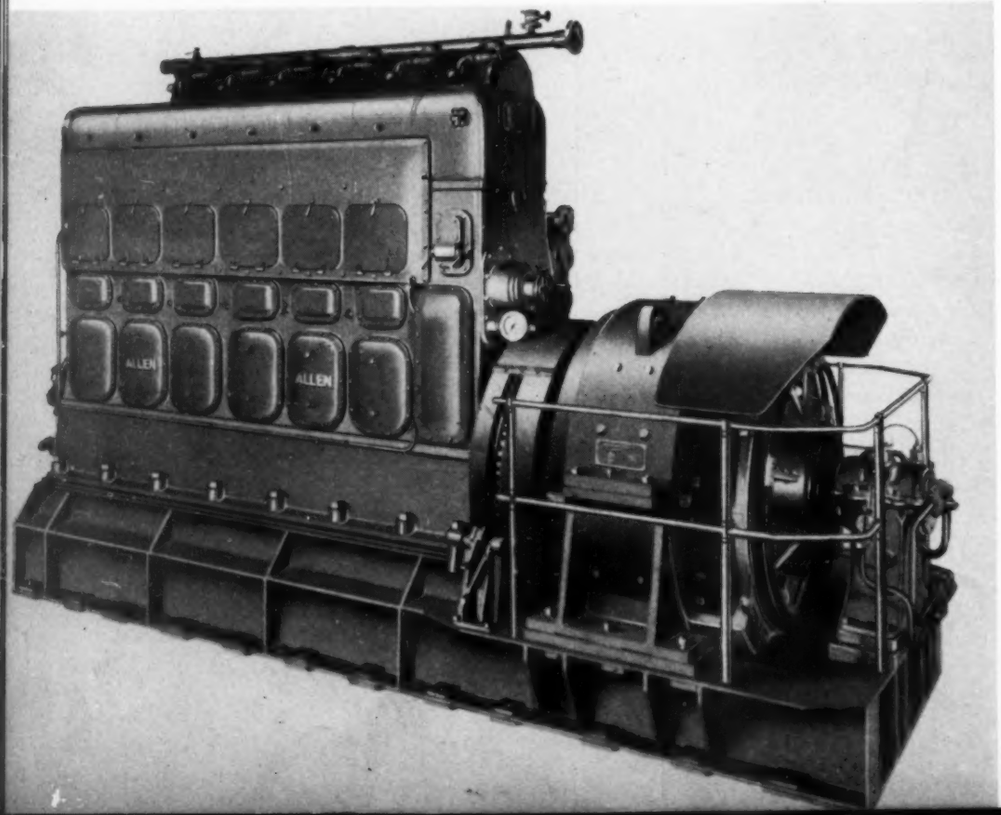
MARINE engine development in Great Britain, excluding Admiralty work, was brought almost to a standstill with the advent of War in 1939. Every ship that could safely put to sea was needed and the vessels of the Merchant Navy sailed unceasingly until they were either sunk or in imminent danger of breakdown. Periods between overhauls had to be considerably extended, yet the engines kept going and Britain's communications were maintained, enabling the delivery of vital food and war materials demanded by the war effort.

Due to these conditions, the British engines now being built are substantially the same in design as the 1929 types, but the severe conditions imposed upon them has resulted in improvements. All the best features have been retained and improved upon and any weaknesses in design have been corrected.



National "F4AU8" type engine. 1000 b.h.p. at 500 r.p.m.

(Below) Allen 2-cycle Diesel generating set wi th 720 bhp. engine and 480 kw. DC generator.



Tonnage under construction in the returns published by Lloyd's Register of Shipping for the three months ended 30th September, 1946, illustrate the growing popularity of the Diesel as against steam for ships up to 20,000 tons gross. The number of vessels under construction in Great Britain and Ireland between 100 and 20,000 tons gross are given as follows:

Gross Tonnage	*Number* Diesel	Steam
100 and under 500 tons	72	41
500 and under 1,000 tons	16	27
1,000 and under 2,000 tons	22	18
2,000 and under 3,000 tons	14	12
3,000 and under 4,000 tons	7	13
4,000 and under 5,000 tons	15	11
5,000 and under 6,000 tons	16	19
6,000 and under 8,000 tons	20	23
8,000 and under 10,000 tons	32	16
10,000 and under 12,000 tons	15	6
12,000 and under 15,000 tons	3	9
15,000 and under 20,000 tons	2	2

It will be observed that 54 per cent of the total are Diesel. Of the world total of 1,019 vessels under construction during this period, 63 per cent are Diesel and of these 36 per cent are being built in Great Britain and Ireland. The figures in Table A are given in respect of the number of vessels commenced and the number of vessels launched during the period under review.

For main propulsion engines in the larger sizes up to 1,500 hp. per cylinder the two-cycle engine is increasing in popularity. The Doxford engine is now being built as a six-cylinder unit developing 10,000 bhp. The largest Doxford-engined ship so far is the quadruple-screw four-engined "Dominion Monarch" built for the Shaw-Saville Line. This ship is 27,150 tons gross and her engines develop 32,000 bhp.

Another engine in common use is the Harland & Wolff, B. & W., double-acting two-stroke which is built in sizes up to 1,250 bhp. in 10 cylinders. The latest engines are of the coverless type and many advantages are claimed for this design. For the smaller engines, up to 3,000 bhp., both four-cycle and two-cycle are in general use.

A major development is the system whereby the fuel-injection pumps are operated by the engine cylinder compression pressure. Having been proved successful, the principle is gaining recognition. Porous chrome-finished cylin-

der liners are becoming more generally adopted for the large size cylinders up to 740 m.m. (29 in.) diameter. For auxiliary engines there is a tendency to step up running speeds and to introduce supercharging. Most of the British engine manufacturers are now offering supercharged models as an alternative to the atmospheric induction type. There are many V-type engines designed with a view to space saving.

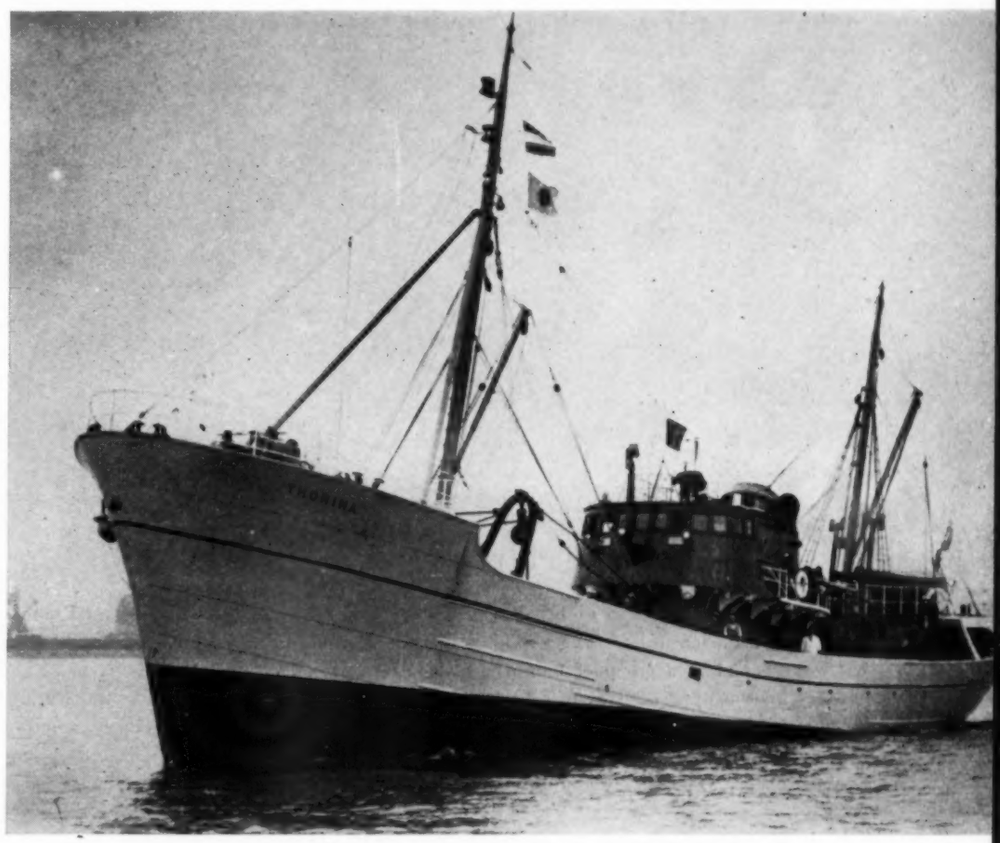
Shipbuilders are at last becoming efficiency-minded regarding the utilization of waste heat. This applies not only to the waste heat in the exhaust gases but also to the cooling water. Exhaust gas boilers are now generally fitted on the larger ships and the steam raised is utilized for operating pumps, etc., and for hotel services. In addition, it is becoming common practice to have a totally-enclosed engine cooling water system using distilled water in the engines, which in its turn, is cooled by sea water passing through heat exchangers. In modern installations the sea water is passed through calorifiers and the heat extracted is used to boost the feed water to the exhaust gas boilers. It is now usual for all fuel and lubricating oil to be centrifuged before being introduced into the engine.

In the future.—It appears unlikely that the top limit of size for motor ships will increase beyond the present standard of about 25,000 tons gross propelled by engines developing about 30,000 shp. at a speed around 120 rpm. Such ships can make about 20 knots. Auxiliary engines will probably increase in speed and pressure-charging will become general. The most interesting pointer towards the future of marine propulsion is the fact that the Anglo-Saxon Petroleum Company proposes to install at some future date in a four-engined Diesel-electric tanker, now under construction, a gas turbine with an output of 1,200 hp. which will be interchangeable with one of the pressure-charged four-stroke Sulzer engines. The turbine is being supplied by the British Thompson Houston Company where the original gas turbines for aircraft were developed. Anglo-Saxon also contemplate the installation of a 6,500 hp. gas turbine with electric drive for a large tanker later on.

However, pending the new developments in gas turbine application, it seems certain that Diesel will increase its influence in the marine field, an influence which is already great. This is especially true in the smaller ship field in vessels of the towing and fishing types. The developments in the fishing field will be discussed in another issue.

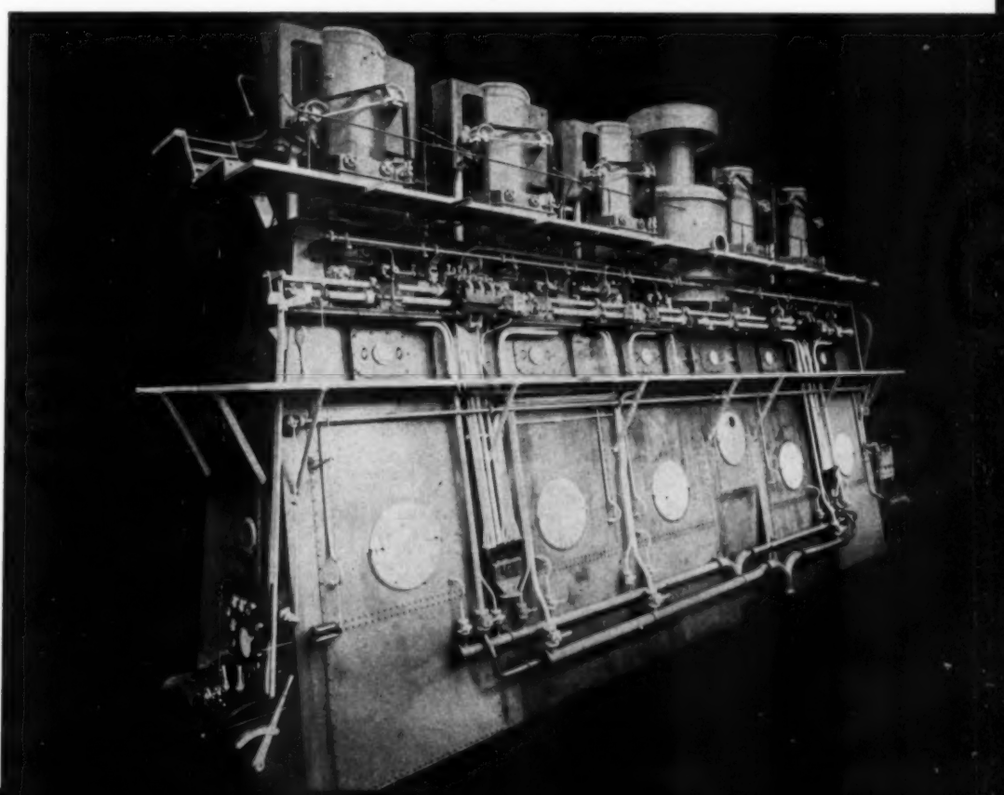
TABLE A

Country	Commenced		Launched	
	Diesel	Steam	Diesel	Steam
Great Britain and Ireland	67	51	40	41
British Dominions and Colonies	16	5	6	4
United States of America	7	9	6	17



133 ft. Diesel trawler "Thorina" built for Arctic service has 8 cylinder, 585 bhp., 450 rpm. Ruston and Hornsby Diesel.

5 cylinder, 6,000 hp. opposed piston Doxford Diesel.



WELDED STEEL TUNA CLIPPER "LISBOA"

By CHARLES F. A. MANN

ANOTHER all-welded steel tuna clipper, *Lisboa,* is busy on the South Pacific coast catching the contents for several million of those standard noonday lunch items in the U. S. A.—tuna sandwiches, after completion at the plant of Birchfield Boiler, Inc., shipyard in Tacoma and a fast run down the coast to her new Southern California home port, San Diego. The *Lisboa* is the second in a group of four all-welded, steel tuna clippers built by Birchfield, for account of the owner-president of that shipbuilding and boiler firm, T. Alvin Davies, the daring young man who started out as a heating and ventilating tinsmith and is now one of the leading North Pacific steel boiler and ship builders. Not to mention being well on the way toward becoming a tuna baron, so to speak.

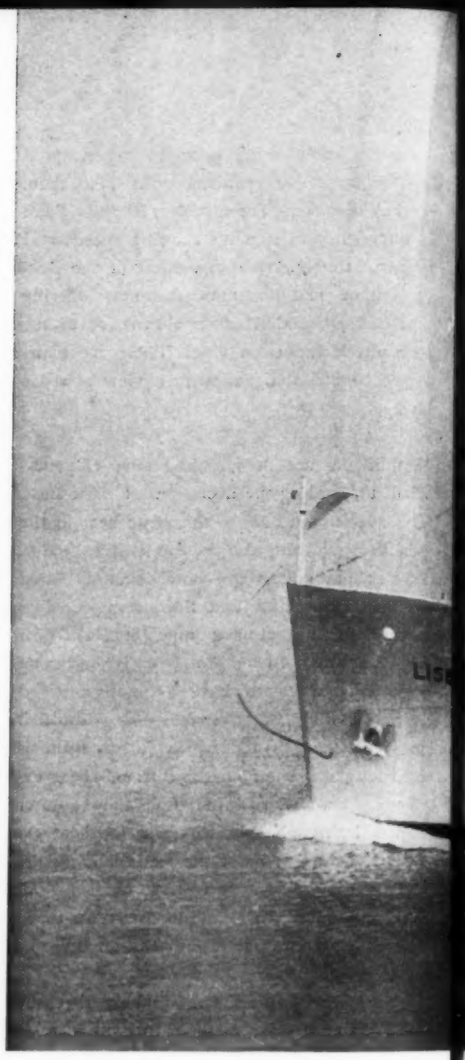
The *Lisboa* is 126 x 27 ft. and has a capacity of 18,000 gallons of fuel oil and 275 tons of frozen tuna in 12 fish tanks below decks and two of her 3 deck bait boxes, on the homeward trip. Every ounce of carrying capacity available in a hull of this size was welded into the ship and she rides so low in the water that the entire main deck is awash in a moderate sea when fully loaded. The conventional tuna clipper design was followed with ingenious features worked into the hull to increase the effectiveness of the crew; efficiency when working and comfort when operating in the tropics as well as the chilly North Pacific. The engine room follows tank and chain locker space, with a big supercharged 850 hp. 8 cylinder, 12 x 15 inch Superior Diesel, supercharged and rated at full power when turning 650 rpm.

Mounted parallel to the main Superior Diesel are two 6 cylinder Superior auxiliary Diesels of approximately 200 hp., each driving a 100 kw. American Machinery Co. (Chicago) generator, to supply the heavy refrigeration and pump load required by the vessel.

The Superior Diesel gives *Lisboa* a turn of about 12 knots when there are no headwinds and a safe 11 knots "for the record," but leave us not fight over the knots—more blood has been shed in talking knots on tuna clippers than there have been fish caught!

After the engine room is the conventional shaft-alley—Pump room, strung out on a steel grating right over the shaft, with twelve 3 hp. vertical brine pumps supplied by Pacific Pumping Co. and the trunklines for ammonia distribution to the galvanized, cork insulated all welded fish tanks, which are used either for bait, outbound fuel stores or dry frozen fish, one well being used to chill and quick freeze, the catch before dry-storing in the rest of the tanks.

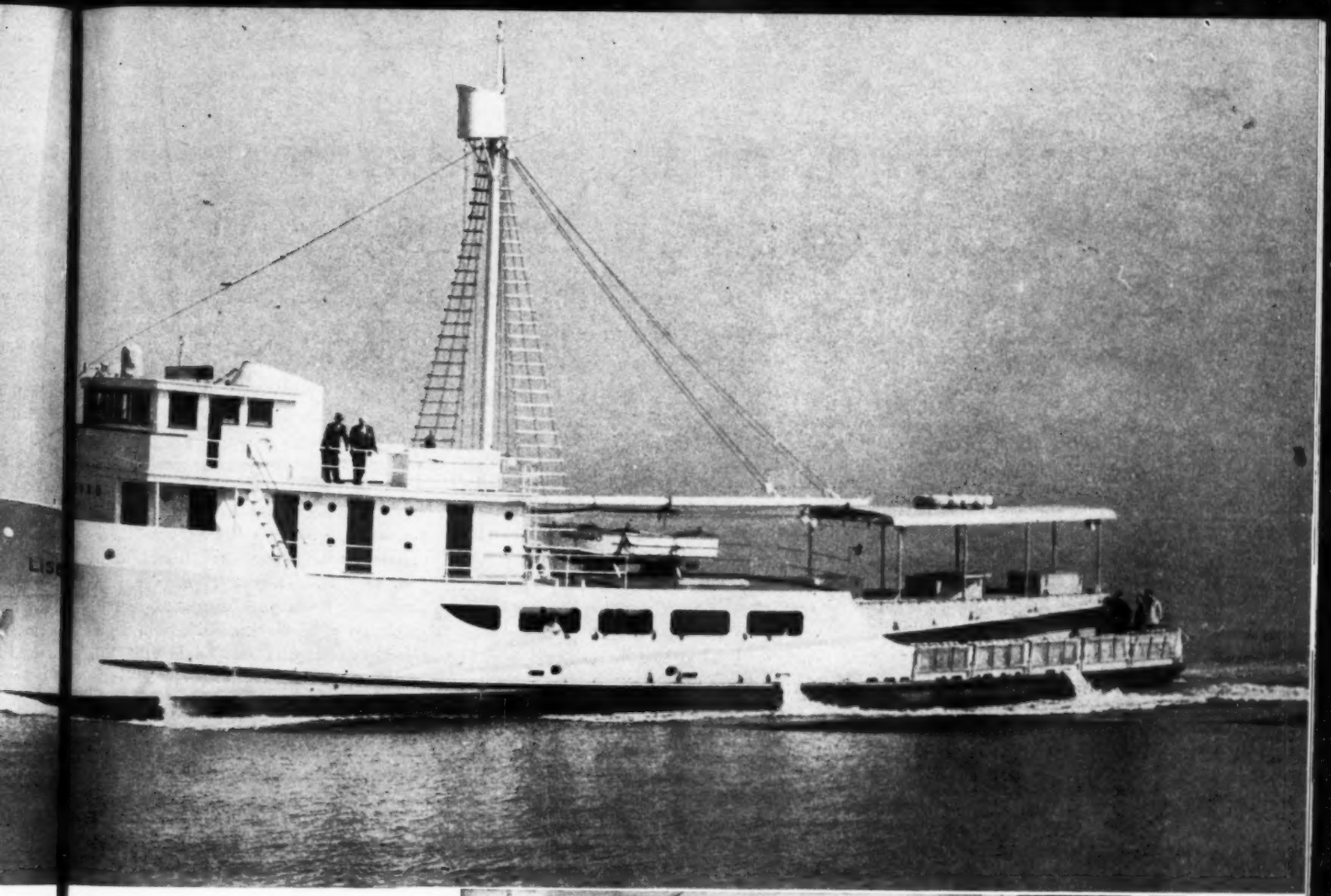
These refrigerated holds, that hold the high-priced tuna even in tropic weather, are served by a Baker ice machine of 6 x 6 inch size and three Kohlenberger 5½ x 5½ inch ice machines, plus another small unit for ship's stores in the galley and in the forepeak, including a stainless steel lined fish and meat chamber as well as milk, fruit and vegetable compartments. Two 3 inch condenser pumps with 7½ hp. motors were supplied as well as a bilge, a fire and two 2 inch rotary oil pumps, all by Pacific except two Fairbanks-Morse brine pumps. Fuel oil and water trim tanks are located far aft over the propeller area.



Taken during trial run, photograph shows "Li... about nine... a cargo carrying capacity of 275 tons of frozen...

Two of these 200 hp. Superior Diesels supply au... for "Lisbo... demand ...wer.

The main deck, containing the ice machines and usual workbench and electric switchboard layout, is followed by a large galley, which is equipped like a modern electric hotel kitchen, then a covered working space over the main fish wells, followed by the big 3-built bait box aft. The upper deck has large quarters for 14 men, each with separate porthole, spring bunks, reading lamps and individual hot and cold air conditioning system, for comfort in the tropics. A large lavatory is fitted separately, as well as four separate staterooms for deck and engine officers. The pilot house is a model of remote-control appointment, with repeating Weston tachometer, full electric Sperry steering gear, wide range, two-way radio set, fathometer, direction finder, searchlights, intercommunicating system for the ship; captain's room and a large owner's room, with extra wide and extra deep full size bed. Sperry steering stations are located on the bridge wings. Electric, automatic or manual steering is provided by this system.

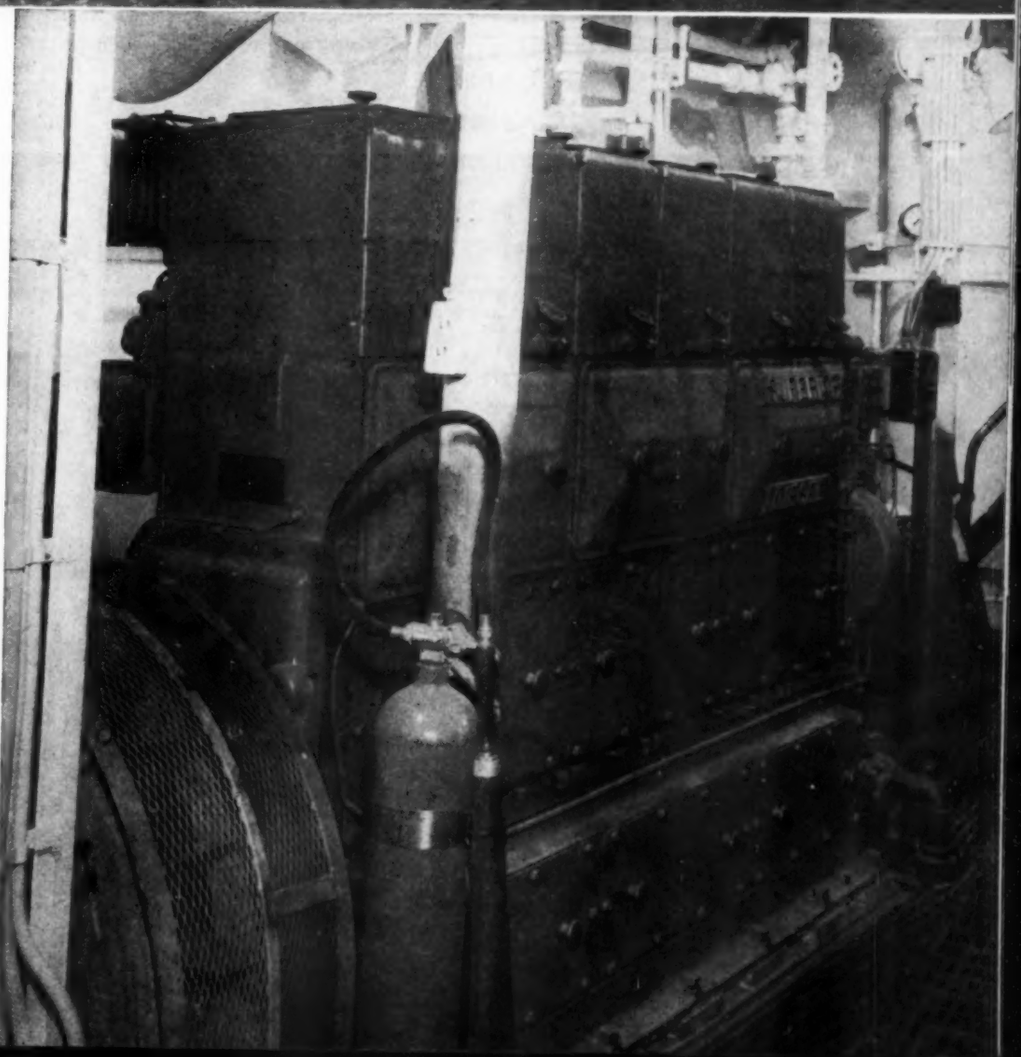


about nine knots. She is 126 x 75 ft. with

for "Lisboa." Refrigeration requirements

a boon to operation in heavy seas or with adverse current, as well as in close quarters. Representing the owner until delivery at San Diego was Elmer Northstrom, purchasing agent of Birchfield. Captain is Anthony Mascarenhas, formerly of Boston and the U. S. Navy and now, at last, his ambition realized, skipper of one of the largest and fastest tuna clippers on the Pacific Coast.

Reports are that on her first trip back into San Diego, right after Christmas, after fishing 70 days off Mexico, was a $78,000 cargo of luscious frozen tuna, and a $2700 cut for each member of the crew and double that for Captain Tony, a remarkable fellow for even in the tuna fishing game. He was Boston born and educated, worked up rapidly in the Navy as a Lt. Commander, yet is 150% Portuguese. His Harvard accent and firey Yankee philosophy has awakened the San Diego fishing fraternity with a jerk.



SUPERCHARGED DIESEL FOR HORTON, KANSAS

By GLENN C. BOYER

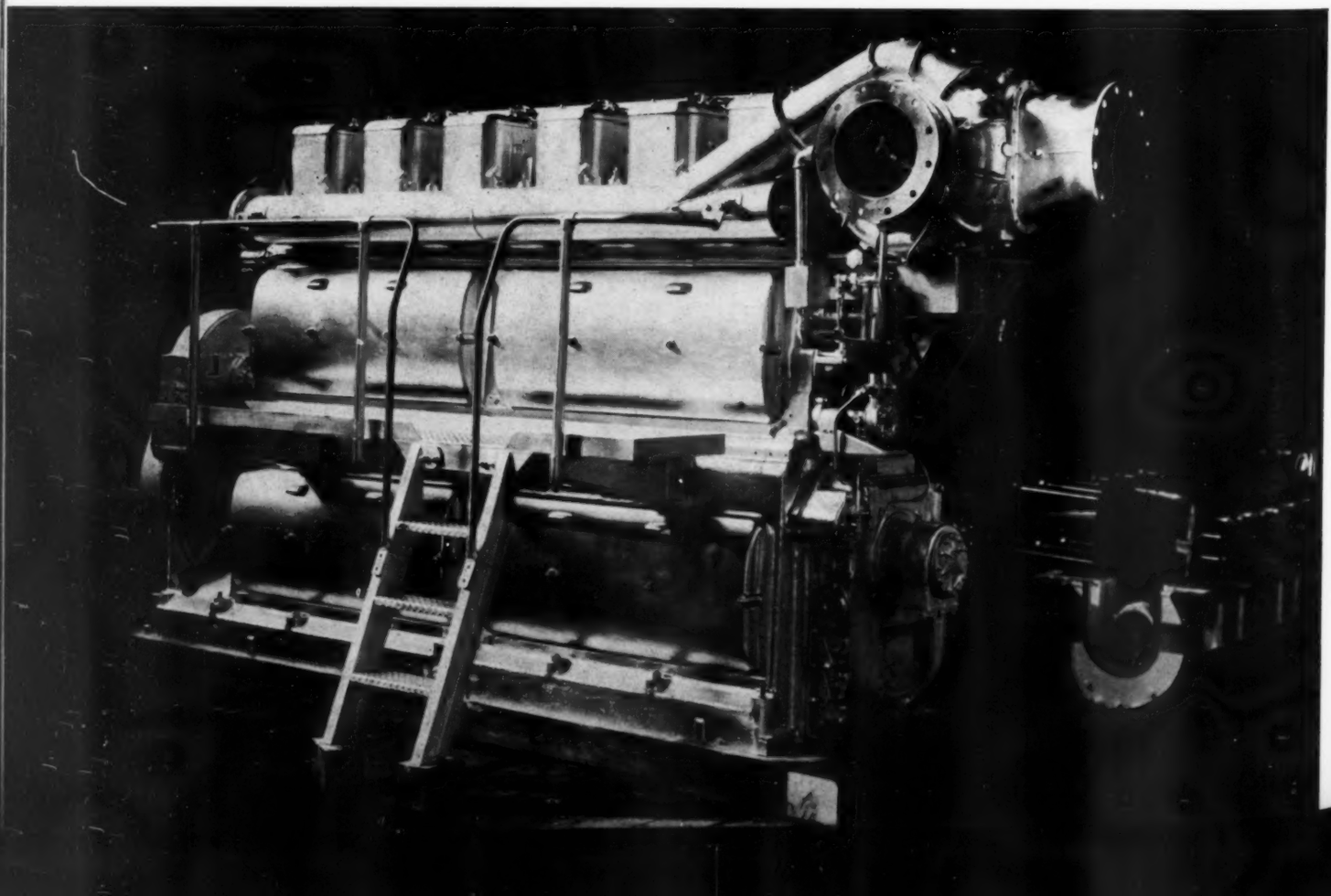
IN 1945 the municipal electric utility at Horton, Kansas realized its need for additional generating capacity. In spite of the fact that the sales of electricity to residential and commercial consumers in Horton had remained relatively static for about seven years. The demands of a rural electrification project in the area near the municipal plant were increasing rapidly. Furthermore while the sale of electricity in the town had been affected by the moving of the Rock Island Railroad shops, the demands of the farmers in the surrounding territory for energy more than offset this loss.

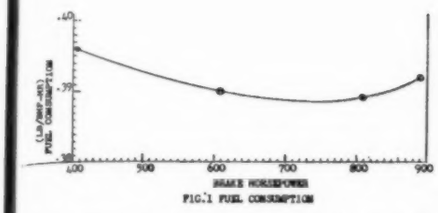
The net result of these opposing tendencies was an increase in power generation of 40 per cent with an increase of 46 per cent in the plant peak load between 1941 and 1945. In 1943 the maximum load on the Diesel plant was 830 kw., in 1944 it was 980 kw., and in 1945 it was 1,210 kw. Investigation of the electrical load demands and generating facilities in the plant showed in 1945 that additional generating capacity was needed and that it could be provided most economically by the installation af additional Diesel generating capacity. This study considered the installation of either supercharged or non-supercharged Diesels as well as the possibility of utilizing steam turbines for prime movers.

Horton was confronted with a most unusual problem in improving its power plant. The R.E.A. was purchasing over one-half of the total electricity being generated in the municipal station. Horton had no long-term contract with the R.E.A. cooperative and this energy for the farmers was being sold on a month-to-month basis. If the City were to install additional generating capacity to meet these increasing demands for electricity brought about by the requirements of neighboring farm consumers, it was confronted by two alternatives. It could (1) take a chance, assume the cooperative would always buy wholesale energy from the city, and embark on an extensive program of power plant extensions, or (2) it could add a smaller generating unit in the existing power plant that would fit into its future requirements regardless of the amount of R.E.A. load it might supply. The latter procedure was adopted by the city officials in making this improvement.

Acting on the advice of their consulting engineers to install additional Diesel generating capacity, and bearing in mind the ever-present possibility that the municipal plant might lose its large R.E.A. load on short notice, the city officials of Horton decided to purchase an Alco

Shop view of 6-cylinder, Supercharged Alco Diesel which develops 810 bhp. at rated load.





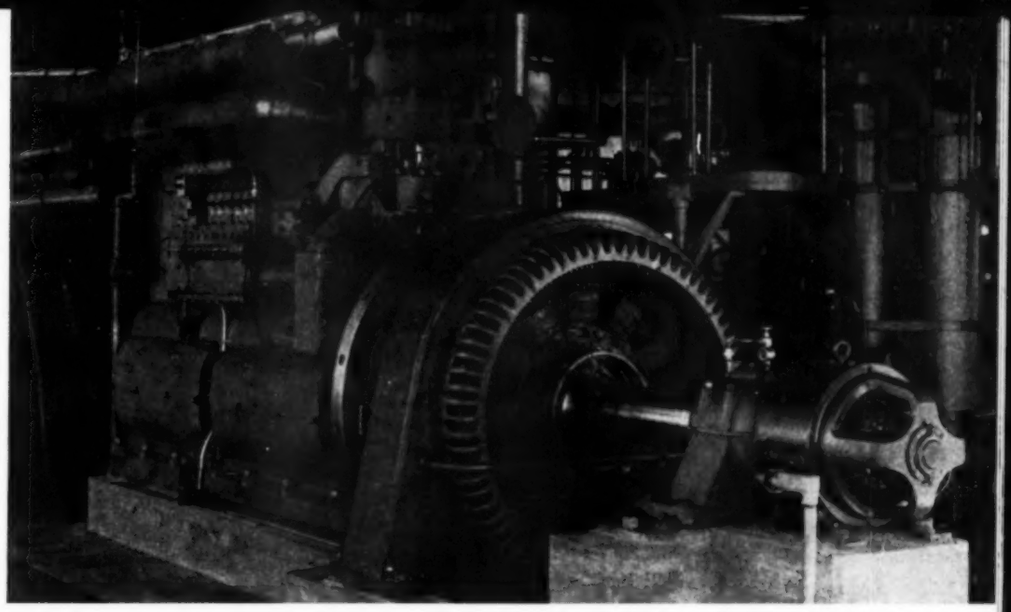
Fuel Consumption Curve for 6-cylinder Alco Diesel at Horton, Kansas.

6-cylinder, four-stroke-cycle, 12½" x 13", 600 rpm, supercharged Diesel engine with a 565 kw. generator. This generating equipment was selected because it would be ideal for handling loads encountered in this plant regardless of the amount of R.E.A. load supplied. The unit was installed late in 1945 and put into operation in January 1946. Operation of this unit during the first five months of 1946 produced very gratifying results. During May the unit generated 117,860 kwh. with an average production of 14.3 kwh. per gallon of fuel oil consumed. Lubricating oil used indicated that between 4,000 and 5,000 rated hp. hours per gallon of lubricant was being obtained.

The surprising thing about the fuel consumption of this engine is the relatively flat fuel curve from one-half to 10 per cent overload, as indicated in Fig. 1. A non-supercharged engine would tend to have a somewhat steeper fuel-consumption curve, the consumption at one-half and 10 per cent overloads being greater than that shown for the supercharged unit. Summary of the shop test data is contained in Table 2.

This is the first supercharged, medium speed, engine, to be installed in the Horton plant. The plant operators have discovered that it is no more difficult to operate a supercharged four-stroke-cycle engine than it is to operate the non-supercharged four-stroke cycle engines with which they were all familiar. The unit has demonstrated its ability to handle its share of the load under any and all conditions.

Reliability of operation was improved, plant fuel economy was raised, and the plant firm capacity increased to 1,395 kw. through the installation of the Alco unit. The municipal plant at Horton is now in position to supply the electrical users in town as well as the farmers in the surrounding territory. And, should the R.E.A. cooperative decide at some future date that it no longer wanted to purchase power from Horton, the new Alco unit will justify itself through helping to improve station fuel economy at the smaller demands of the city load alone.



Installed at Horton, Kansas, power plant, Alco Diesel drives 565 kw. Elliott generator. At right is one of two Worthington Diesels.

Table 2—Summary of Shop Tests Alco Engine

Engine Load bhp.	890	810	607	405	203
Per Cent Rated Load	110	100	75	50	25
Guaranteed Fuel Consumption* (5% Tolerance)		0.385	0.390	0.425	
Test Fuel Consumption*	0.392	0.389	0.390	0.396	0.455

* Pounds per Bhp.-hr. corrected to 19,000 Btu. per lb.

Table 1—Electrical Energy Production, Horton Plant

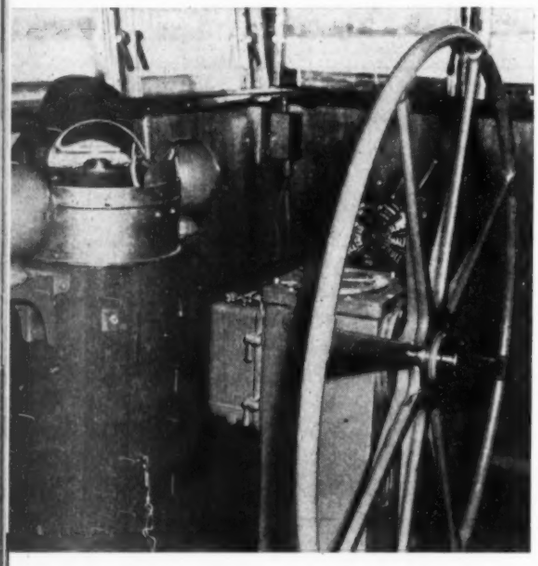
Year	Generation kwh.	Plant Peak Load, kw.	Energy Supplied to Distribution City, kwh.	Rural, kwh.
1939	2,173,870		1,526,670	647,200
1940	2,439,100		1,498,200	940,900
1941	2,758,570	830	1,540,686	1,217,884
1942	2,920,020	750	1,407,036	1,512,984
1943	3,097,840	830	1,403,156	1,694,684
1944	3,547,130	980	1,543,646	2,003,484
1945	3,880,830	1,210	1,625,030	2,255,800

View of Horton's municipal plant whose Diesels generated 3,880,830 kwh. during 1945.

STEEL TRAWLER "FEARLESS"

By BRUCE C. SISSON

WHILE much has been said and written about the rapid strides made in the fishing industry on our west coast, the Atlantic fishermen in their quiet way have been keeping pace with the newest in the way of equipment that will aid their business. Forward looking operators in the Boston area have installed Loran on one of their boats. Others are investigating radar. Other operators with an eye for more speed and power have re-engined their boats making sure that they will be among the leaders in the fortnightly race to the New England fish wharves for good prices. Other operators are building new boats and outfitting them with the best equipment available.



Pilot house of "Fearless" showing steering stand.

The Atlantic Coast Fisheries Co. is one of the latter, having purchased a new trawler, one of the largest now in service. The *Fearless* is 140 ft. 9 in. long with a beam of 25 ft. 6 in. Her gross tonnage is 398. She was designed by Colley-Maier, Inc. and built by the John H. Mathis Company of Camden. Her Maierform hull is designed for speed and her 805 hp. Diesel supplies it, enabling her to live up to the reputation of her namesake, a famous clipper ship built in the 1850's. Of course there is plenty of heavy duty hauling in the life of a trawler, its not all speed by a long way.

When the 140x40 foot trawl net is rigged and streamed, it takes a lot of horsepower to keep the net open and at the proper angle.

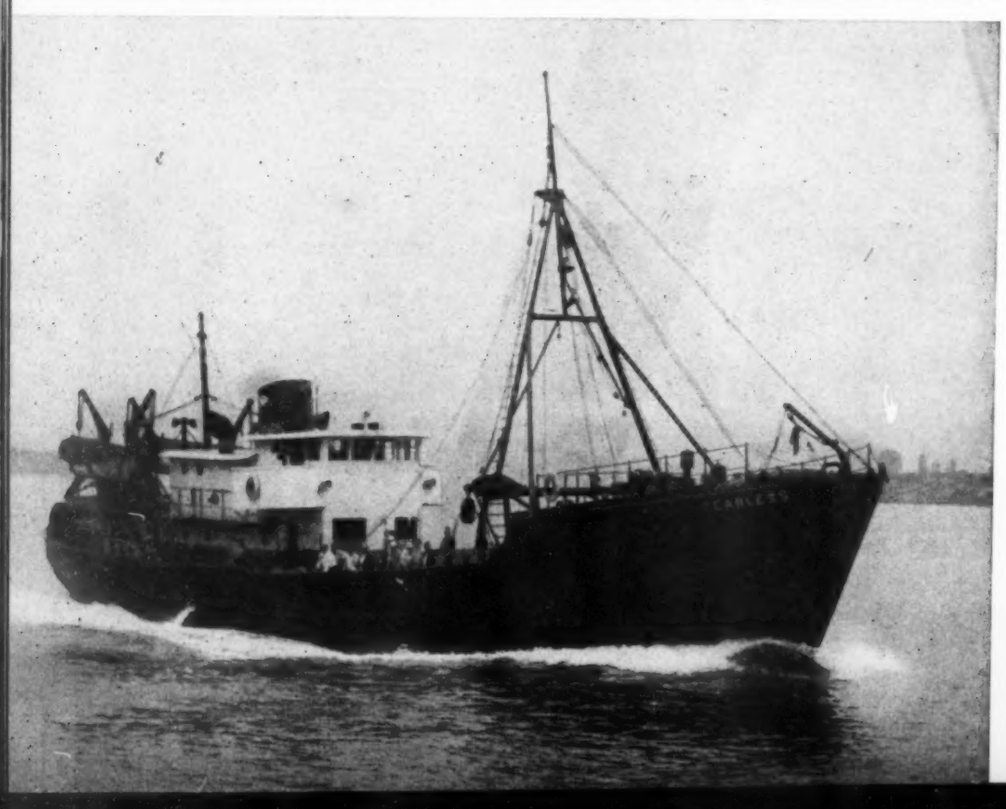
The *Fearless* started her career with outstanding success for on her 6-day maiden trip she came back with a 157,000 lb. catch including 93,000 lbs. of haddock.

The power plant aboard the *Fearless* consists of a 7 cylinder, 805 hp., 300 rpm. Fairbanks-Morse Diesel propelling the vessel at a cruising speed of about eleven knots. A 25 kw. tailshaft generator supplies a portion of the auxiliary load along with a 25 kw. General Motors Diesel set. An 80 kw. General Motors Diesel generating set powers the heavy trawl winch. Engine auxiliary equipment includes Maxim Silencers, a Youngstown Miller oil purifier.

The pilot house reveals the modernity of the ship just as the engine room. The first thing one notices is the Sperry steering stand and the companion steering controllers located on the bridge. These remote control stations are handy for the skipper for it permits him to control the ship alone. Teleflex engine controls adjacent to the remote steering stations make this possible. A Bludworth radio direction finder, a fathometer by Submarine Signal Co. and a 75 watt radio telephone assure safe navigation.

The *Fearless* has several features new in trawler design in that owners quarters have been installed. This cabin, located aft of the wheelhouse is very roomy and is equipped to accommodate up to four persons when two additional berths of the pullman type are made up. Adjacent to the owners cabin is a lavatory and shower. There is berthing space for 12 crew members in the foc'sle. The mates and engineering officers are quartered in the after part of the ship in single and double cabins. The galley is large and well equipped for extended trips with a large capacity cold storage unit.

Trawler "Fearless" 140 ft. 9 in. long, 25 ft. 6 in. beam powered by 805 hp. Fairbanks Morse Diesel.



There seems to be a growing tendency on the part of the fishing industry to build larger boats. The *Fearless,* for instance, is the largest east coast trawler to be built in five years and soon her sistership *Challenge,* another 140-footer will be ready for service.

Navy and Coast Guard veterans who have returned to the fishing fleet exert an influence in favor of the new navigational devices that they became acquainted with during the war. Older skippers quickly come around to the same point of view as they see the advantages in new methods.

But as far as power plants go oldtimers and young men alike have long since decided on Diesel. There is no gamble. Fishermen know what Diesels will do. As the first assistant engineer of the *Fearless* said, "I've been working with Diesels for twenty years and I'm satisfied."

HYDRAULIC VALVE ADJUSTERS

By CARL VOORHIES*

THE Diesel engine industry has been more aggressive than the automotive industry in adopting hydraulic valve adjusters. This is undoubtedly due to the fact that hydraulic valve adjusters have been found to improve performance, increase valve life, and reduce servicing requirements so materially that these advantages cannot be ignored. In this discussion we hope to explain how and why hydraulic valve adjusters achieve these various results.

In Diesel design the primary objective is to produce an engine which will be free from mechanical failure, and which will require a minimum of service attention, such as adjustment and the replacement of parts. Quiet operation, while desirable, is not ordinarily a primary consideration in Diesel design; however, noise in any mechanical motion is an indication of vibration or shock loading, and these factors are important in the breakage or rapid wear of parts. The requirement for frequent adjustment is also a negative, as neglect of adjustment invariably leads to various types of failure. This is particularly true in connection with the valve gear. For example, with an adjustable valve gear which tends to widen its clearance, the valve seating velocity may go from a normal 1 to 2 feet per second, to 5 or 6 feet per second, with a relatively small increase in clearance, as shown in Figure 1. Note the change in velocity between normal clearance and increased clearance. Since the impact load of the valve seating increases directly as the velocity, this would indicate an increase of 315% in impact load.

In working with engines in which the tappet clearance increases as the temperature rises, cases have been found where the tappet clearance was adjusted hot, and the valves were damaged in starting cold before reaching normal clearance. Likewise, with clearances adjusting cold, they opened up a sufficient amount when the engine reached running temperature to move the closing point away from the ramp of the cam and close the valve at excessive velocity, causing breakage. Hydraulic adjusters in such engines have corrected both these types of trouble.

In considering engines in which valve clearance tends to decrease as temperature rises, one of the common problems is to allow sufficient clearance to take care of extreme operating conditions. It is obvious, since a considerable percentage of the cooling of a valve is accomplished by transferring the heat from the seat of the valve to the block, that, when the valve is held open by some temporary cause, the temperature of the valve rises. Because of the resulting expansion in the valve itself, this rise in temperature often may be sufficient to cause the valve to remain in the open position even when the initial cause for holding the valve open is removed. Thus, it may not seat again until the load has been reduced to permit sufficient cooling.

The use of hydraulic valve adjusters is an assurance that valves cannot hold open under any operating condition except when this condition is caused by stem deposits or broken springs. Even then, when the initial cause is removed, the valve will close quickly and, if too much damage has not already been done, will continue to give satisfactory service.

An initial adjustment is all that is necessary for hydraulic adjusters, and this adjustment is unnecessary when the parts can be held to limits that will put the units within their operating range. This range is usually ⅛ in., but, in some cases, has been made as much as 15/16 in. and as little as 1/16 in., depending upon the individual requirements. This adjustment need not be made accurately and can be done by giving the adjusting screw a certain number of turns from either extremity of the range of the unit. After this initial adjustment, compensation for change in clearance is assured.

Hydraulic valve adjusters are used in a considerable number of automotive, aircraft, and Diesel engines. Figure 2 shows an ordinary automotive application and will be used to describe the operation of the adjuster. The assembly is composed of the adjuster body, A, which corresponds to the ordinary tappet, and the hydraulic unit or compensating member, B. The unit is removable from the body and is essentially universal for automotive installations.

Oil is supplied to the adjusters at regular

* *Wilcox-Rich Division, Eaton Mfg. Company.*

Fig. 1 below shows increase of valve seating velocity with increased tappet clearance. Fig. 2 at left shows ordinary automotive type valve adjuster which compensates for valve gear expansion. Fig. 3 shows valve adjuster with "eccentricity compensator."

Fig. 2

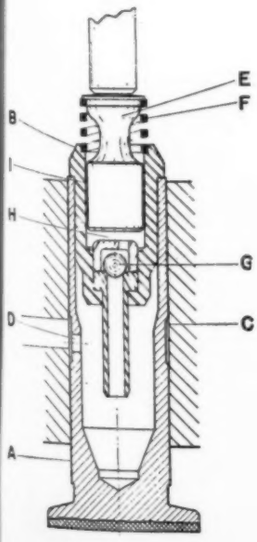


Fig. 1

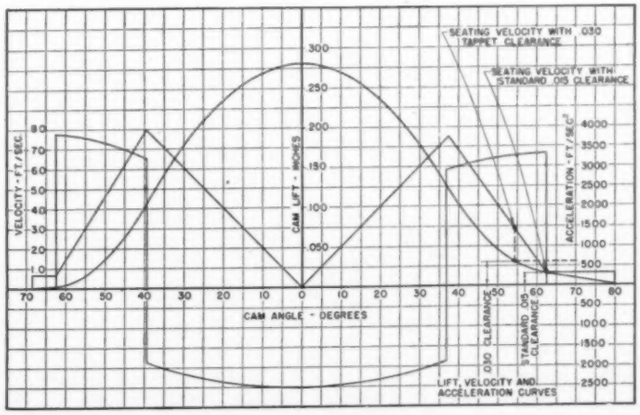
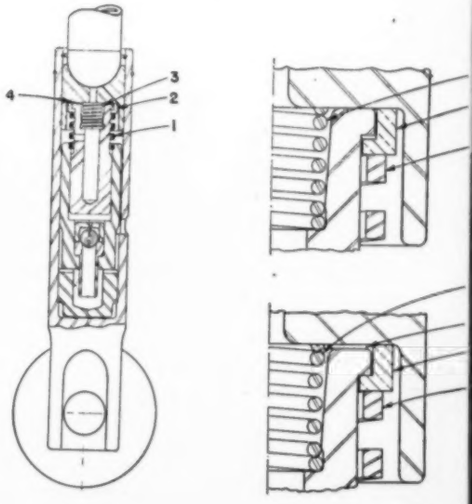


Fig. 3



engine pressures. An annular groove, C, is provided on the tappet body to maintain registration with the oil feed, and the oil is delivered to the adjuster body through the drilled opening, D, in line with the annular groove.

In a complete cycle of the cam, starting with the adjuster on the base circle, the hydraulic plunger, E, is actuated outwardly by the plunger spring, F, to take up any clearance between the end of the valve stem and the cam. As the cam revolves, the initial pressure developed seats the check ball, G, so that oil under the plunger is trapped and the valve is lifted on a column of oil at H. During the interval when the valve is lifted off its seat, a slight oil leakage occurs between the plunger and cylinder at I which is necessary to compensate for any expansion in the valve gear. During the valve-closed period, the chamber below the plunger is replenished with oil, thereby eliminating all clearance.

In some engines where the runout of the cam is considerable, the valve may be cracked open for a part of the base-circle travel. In order to overcome this, an "eccentricity compensator" can be incorporated in the unit. While different types of eccentricity compensators have been developed, the principal one is shown in Figure 3, a radial engine installation. During the time the unit is filling, the horse shoe collar (2) provides a stop for the spring (1), and the plunger is held down against the shoulder in the washer by the small spring (3). This arrangement provides a predetermined amount of clearance at (4). This amount of movement will then be required before the valve can be lifted.

The various sizes of units are rated according to the plunger diameter (see Figure 4). The size selected for a given engine depends on valve gear loading, most large Diesel engines requiring the ⅝ in. unit, which will withstand a maximum load of 4100 lbs.

The hydraulic unit may be located in the tappet, in the upper or lower end of the pushrod, or in the rocker-arm. When installed in the rocker-arm, the unit is usually placed on the pushrod side, but, in a few cases, it has been applied to the valve side. In addition to these applications, in at least one experimental case, the unit was located at the fulcrum point of the rocker-arm.

The application in the most common use in Diesel engines, is the rocker-arm type with the unit installed on the pushrod end. Figure 5 shows the hydraulic adjuster as applied to a large Diesel engine.

Figure 6 shows an unusual application where a ½ in. unit is applied to the lower end of the pushrod. Figure 7 shows a type of application with the unit at the top of the pushrod, which has been tried experimentally. While it has operated successfully in several engines, there has been no occasion to use the application in production. Figure 8 shows a production application in an air-cooled aircraft engine. A 7/16 in. unit is shown installed in the tappet, the pushrod socket being integral with the plunger. Figure 9 is a view of a radial engine valve gear with the hydraulic unit installed in the tappet.

There has been in common use a variety of different means for axially shifting the camshaft in a direct reversible engine. The Wilcox-Rich Engineering Department, working in conjunction with Baldwin-Locomotive, has developed a method of lifting the tappets for shifting the camshaft, which may be of some interest.

This design was applied experimentally to the Baldwin VO engine, which is a 12¾ in. bore, 15½ in. stroke, 625 rpm., 8 cyl. model (see Figure 10). When there is no oil pressure to the tappet body, the spring, A, at the top of the tappet holds the tappet off of the camshaft to the extent of the travel of the hydraulic unit which, in this particular case, is ⅞ in. When the oil pressure is applied, the pressure acting on the area of the plunger, B, overcomes the body spring, A, and forces the tappet down on the cam, at the same time supplying the oil for hydraulic operation of the adjuster. The oil pressure also exerts a force on the lower piston, C, which overcomes the spring, D, in the bottom of the bore. When the oil pressure is shut off, this piston moves upward, actuated by the spring, lifting the check ball, E, off of the seat. At the same time, the body spring moves the assembly upward, causing the oil to leak past the check valve out of the high-compression chamber of the hydraulic unit and

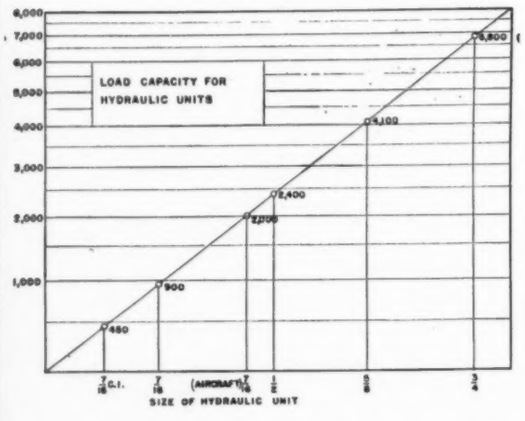
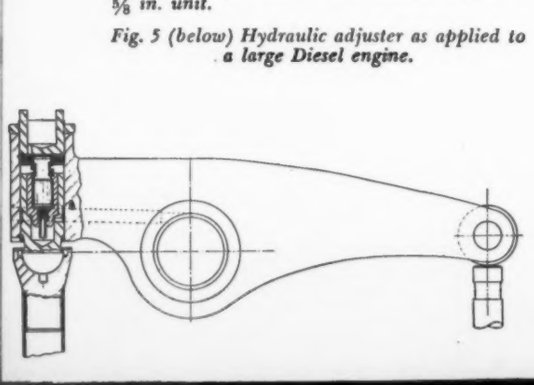


Fig. 4 (above) selection chart for determining proper plunger size. Large Diesels require a ⅝ in. unit.

Fig. 5 (below) Hydraulic adjuster as applied to a large Diesel engine.



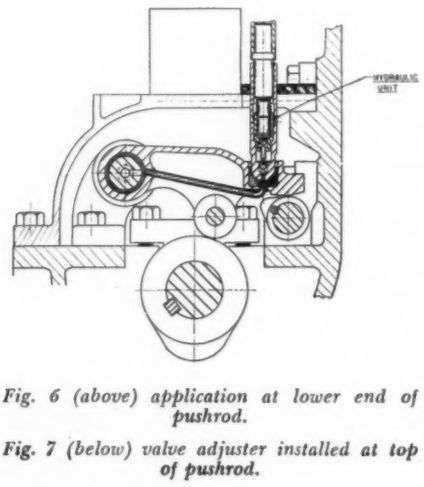
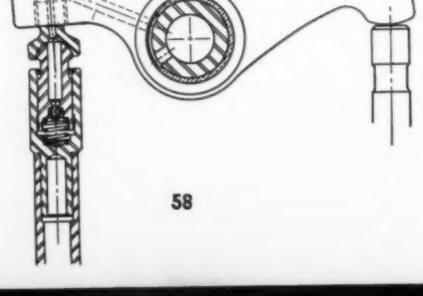


Fig. 6 (above) application at lower end of pushrod.

Fig. 7 (below) valve adjuster installed at top of pushrod.



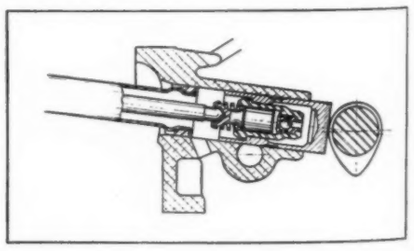
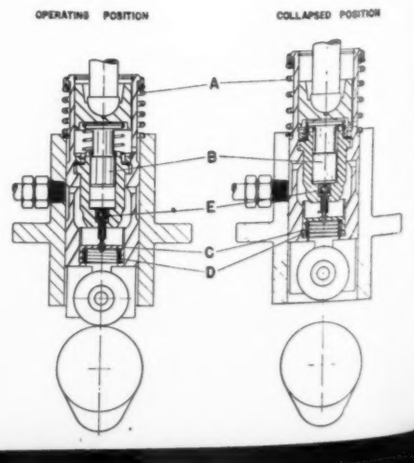


Fig. 8 (above) application on aircraft engine. Unit installed in tappet.

Fig. 10 (below) adjuster application for Baldwin Diesel permits shifting of camshaft for reverse operation.



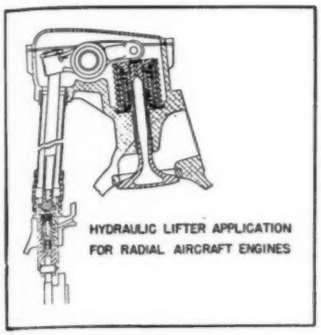


Fig. 9 (above) Radial engine valve gear with the hydraulic unit installed in tappet.

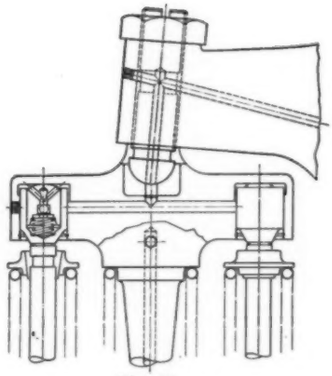


Fig. 11

Fig. 11 (above) 2-cycle Diesel application with four exhaust valves operated in pairs by a common bridge.

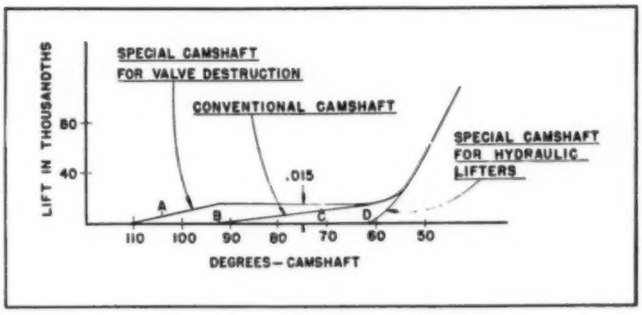


Fig. 14

Fig. 14 (upper right) Ramp for conventional camshaft, special ramp for valve destruction, and lift curve with special camshaft for hydraulic adjusters.

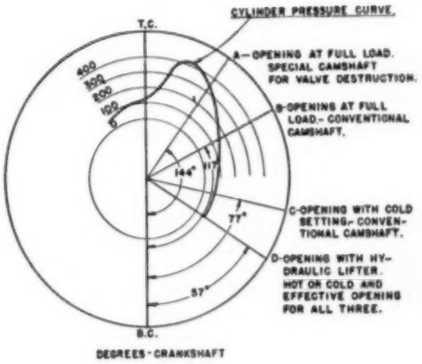


Fig. 13 (right)

Fig. 13 (right) Radial timing diagram of automotive engine on which is superimposed the cylinder pressure curve.

Fig. 12 (below) Component parts of unit shown in Fig. 11 installed on 2-cycle Diesel.

the roller to clear the base circle of the cam by $\frac{7}{8}$ in. This permits shifting of the cam for reverse operation.

Tests indicate that with SAE-40 oil at 135° F. and 125 psi. pressure, the assembly requires 0.4 sec. to expand to the operating position, and 0.3 sec. to collapse into the shifting position. Using the same oil at 32° F., 1.6 sec. are required to expand and 3.0 sec. to collapse.

Figure 11 shows the application to a 2-cycle Diesel engine having 4 exhaust valves in the head, operated in pairs by a common bridge. Note that the units are placed over the valve stems and are individually adjustable for each valve regardless of the relative position of the ends of the valve to the bridge. This application has been very successful in production and constitutes a considerable advancement in the development of hydraulic valve adjusters, in that it occupies a smaller space than has ever been made previously to carry the loads imposed upon it.

Some details of the assembly of this unit may prove interesting, so one side has been shown in cross-section. Figure 12 shows a detailed view of the parts. It will be seen that none of the parts are pressed together and that the unit is accessible for cleaning or examination during overhauling or whenever occasion should arise.

The check valve seats on a hardened radius in the plunger and is retained in position by the flat plate, which in turn is held in place by a snug fit of the spring in the bore. The spring then snaps lightly into the bottom of the cylinder bore merely to hold the unit together for handling purposes. The helical grooves shown in the cylinder provide ample lubrication to the bearing surfaces between the plunger and the cylinder, and also provide a positive means of leakdown control in manufacturing.

The unit operates the same as the one previously described except that the oil is fed in at the top of the plunger, and the position of the check valve is revised, being located in the plunger instead of in the cylinder.

Where hydraulic adjusters are used, the timing remains constant throughout the entire temperature range of the engine, and is unaffected by wear of any of the reciprocating parts. This is a very great advantage in any engine in which tappet clearance increases as the temperature rises, as it obviates the necessity of compromise in the cam design for starting and idling. It is also decidedly advantageous in any engine in that it eliminates the necessity for using a long ramp in order to lift and seat the valve at low velocity throughout the temperature range. The use of long ramps imposes an extra amount of punishment on the valve, example of which is shown in Figure 13. This chart was taken from data obtained on an ordinary automotive engine, and represents a radial timing diagram upon which is superimposed the cylinder pressure curve in heavy line. The manufacturer gives D as the timing point for the opening of the exhaust valve, but allowable clearance variations bring the cracking point of the exhaust valve to C. At full throttle, maximum power, the clearance is reduced to bring the cracking point of the exhaust valve to B. In order to accelerate valve destruction tests, for which this engine is used, a camshaft was designed with a special ramp which brought the cracking point of the exhaust valve to A. This arrangement cut the test time about in half; in other words, moving the cracking point from B to A doubled the destruction of the valve.

Figure 14 shows three ramps; the center one is the conventional ramp used on this engine in production; the upper one is the special ramp for valve destruction; and the lower one, or rather the lift curve shown without a ramp, is the one which may be used with hydraulic adjusters.

The most important advantages of hydraulic adjusters are increased valve gear life; elimination of frequent adjustment and down time; consistent engine performance in so far as the valve gear is concerned; and the possibility of increased engine performance through changes in cam design. These and other advantages attending the use of hydraulic adjusters make them desirable in modern engine design.

DOCKBUILDER'S DIESELS PROVE VERSATILE

By FRED M. BURT

TWO major construction jobs now underway (at this writing) for the Navy on the waterfront of San Diego Bay, rely heavily on Diesels for a diversity of operations. First is the construction of a concrete quay 3,172 feet in length and second is the building of 4 piers jutting out from the quay. These piers are 1,458 ft. long and 30 ft. wide, erected on reinforced concrete piles and with concrete decks. These jobs are but two of many executed for the Navy in war times and since, running into many millions of dollars, by the M. H. Golden Construction Company of San Diego.

The diversity of the jobs requires a huge amount of equipment selected and often specially designed. Much of the equipment is Diesel-engined and as new units are added they run heavily to Diesels. For instance, in addition to the units that will be described in relation to these two construction jobs, other Diesel units include Gardner-Denver portable compressor units powered with Buda-Lanova Diesels; a Worthington jet model pump, 635 cfm. at 500 rpm., powered with a Hercules Diesel: three large Caterpillar Diesel tractor-bulldozer units; a large Lorain crane tractor unit with a 1¼ cu. yd. bucket, powered with a Caterpillar Diesel engine. Also a number of portable Caterpillar Diesel-electric sets.

The operations start on shore at the Batch plant, just back of the quay wall where large loads of aggregate, sand and two sizes of rock, are trucked in and dumped into three large bins. These are discharged by gravity, down through lever-controlled chutes, on to a 24 in. rubber conveyor belt, one after another, to be carried 262 ft. to a 40 ft. height for discharge into hoppers. A silo receives cement which drops from hopper bottom railroad cars into the hopper of a screw conveyor in a tunnel below ground level. The screw carries the cement to a bucket elevator for discharge into the silo. These raw components of concrete are weighed out in proper, pre-set proportions, into a weighing-discharge hopper at an elevated level, in a fully automatic, highly precise manner. Five solenoid-operated, two-way air valves open and shut gates, to control the flow of the proper components into the hopper. The air at 70 lbs. pressure comes from an Ingersoll-Rand 80 cfm. compressor. Cement is fed in for weighing by a screw conveyor running from the bottom of the cement silo. Aggregate drops down from the hoppers through carefully controlled feed gates.

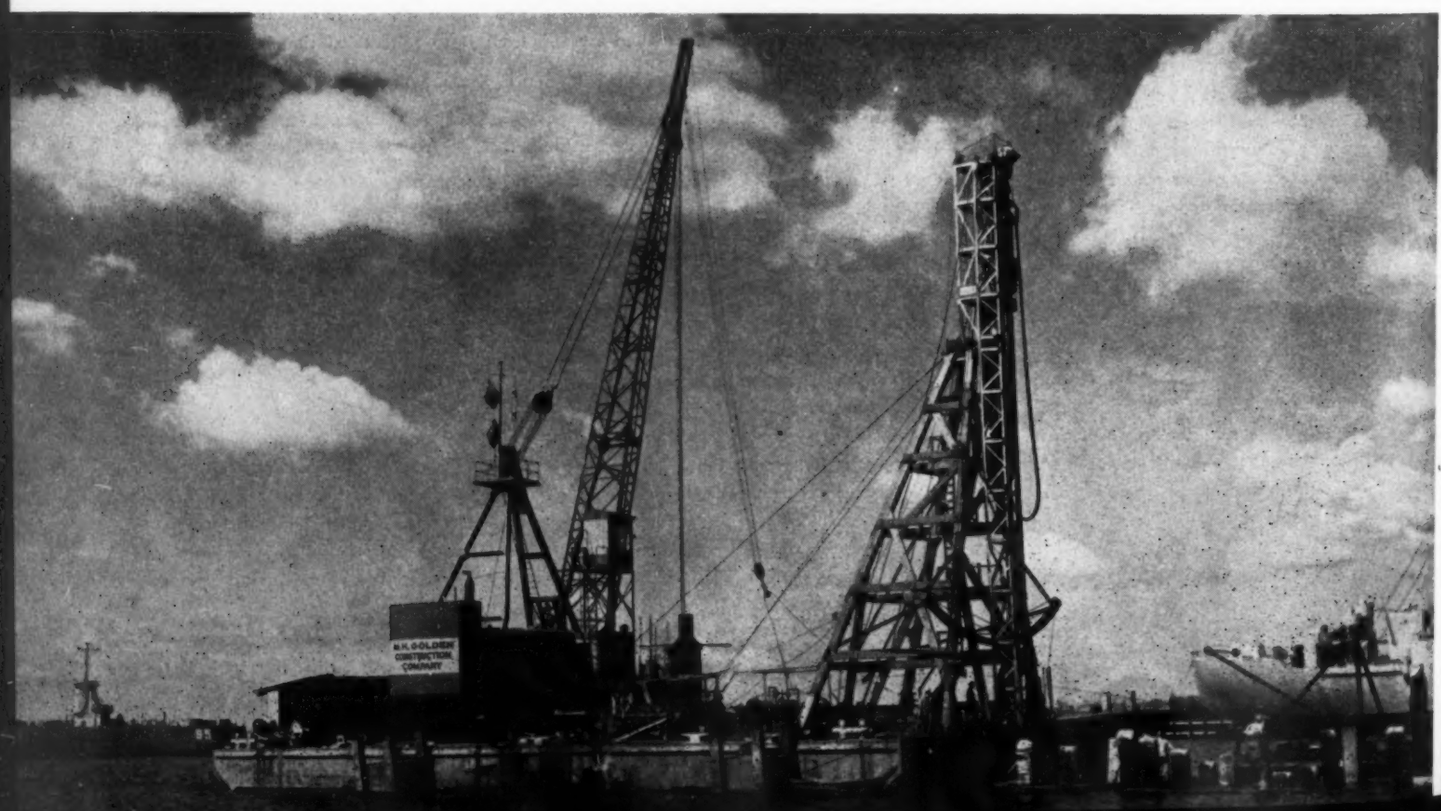
The weigh-beam for each component is set for the proper weight and then when the operator actuates the mechanism through his controls, the first gate opens and the aggregate starts flowing. Soon an upper beam starts rising and a beam-mounted shield cuts off the beam from an "electric eye." This partly closes the gate controlling the flow. As the pointer on the beam reaches the "0" (zero) mark, another shield cuts off another electronic beam to cut off the flow entirely. The same action continues automatically with the other components and their weigh-beams.

The final batch is then discharged by gravity into trucks below. These trucks are divided into four compartments, each holding 1-1/10 cu. yd. batches. These trucks deliver their loads to a Rex Paver which has a double drum mixer, with a total capacity of 2½ cu. yds. The mixer is powered with a Waukesha-Hesselman multi-fuel engine.

This mixing unit can easily be moved under its own power to any location where it is to be used. When moved onto a pier to provide concrete, it feeds into a concrete pumping machine which feeds under pressure through pipelines to a movable chute down which it travels to the forms.

In building the quay wall, rows of five wooden, 48 ft. piles were driven, spaced the width of

Golden's pile-driving barge finishes driving last pile on pier 11. At left is seen the 120 foot boom which handles the 60 foot piles. It is Buda Diesel-engined. Twin Gray Marine Diesels and a Sheppard Diesel supply auxiliary power needs.



the wall. These are supplemented with two longer, batter (slanting) piles. On the seaward side there is also a heavy sheet steel facing, made up of interlocking units. Then forms were erected on the piles to contain and set the poured concrete.

In this case, the mixed concrete from the movable unit, is poured into a 1 cu. yd. bucket which carries it to the point of pouring. The bucket is handled by a Lima Locomotive Works 8 ton capacity, crane-crawler. This unit also has a wide variety of uses and is powered with a Waukesha-Hesselman oil engine of 226 hp., 6 cyl. 7 in. x 8½ in., 1050 rpm.

Power for lights and to operate vibrators was supplied from a portable Caterpillar Diesel-electric set—37½ kva., 30 kw., 1200 rpm., 440 volt, 3-phase, self-regulating—a unit that followed the job along.

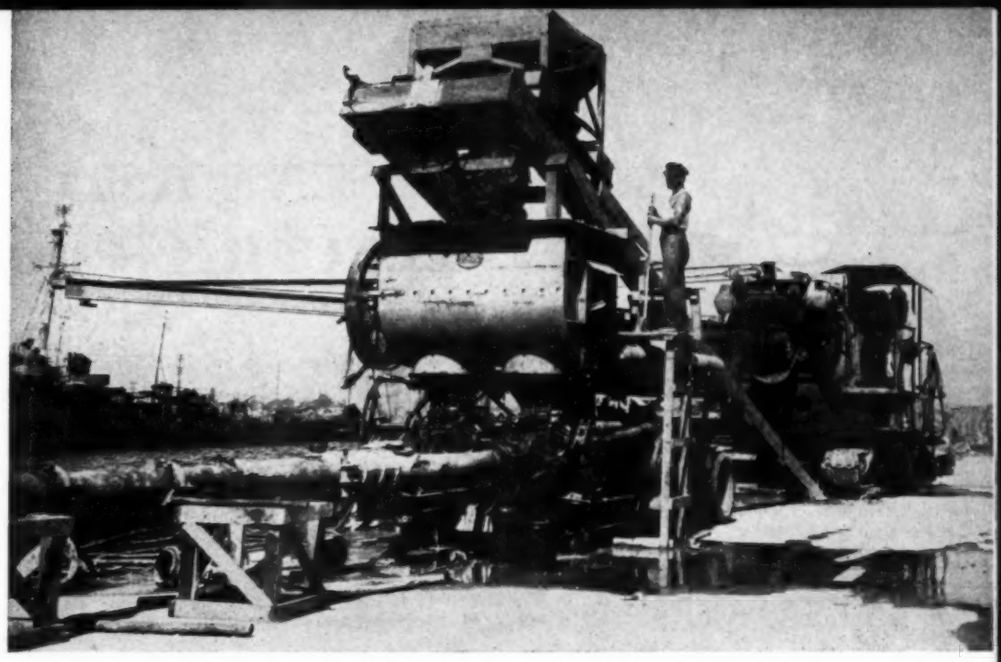
Steel forms for 52 concrete piles are first placed at ground level, separated by wooden strips. After placement of re-inforcements and concrete pouring, the wooden strips are removed to loosen the forms. These are then re-placed on top of the first set of piles and another 52 are cast. This is continued six high—312 piles. The piles must age or cure for a minimum of 28 days before they can be driven.

After the piles attain a proper strength for handling, they are picked up by one of the Diesel cranes, with four grab hooks that there may be no distortion of the long member. The piles are crane-loaded on to a barge for towing to the pile-driver barge.

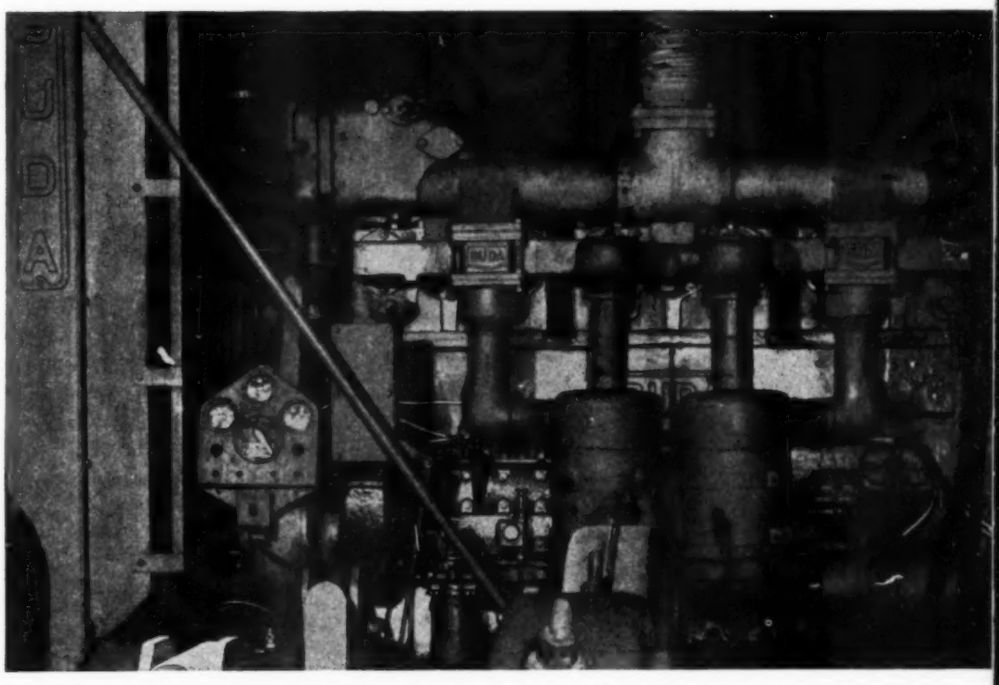
In the engine house of the pile driving barge there is a Buda-Lanova Diesel engine, 170 hp., 6 cyl., 6¾ in. stroke x 8¾ in. bore, 900 rpm., 4 cycle, with an electric starting motor.

Beneath the engine there is a small compressor and tank to supply the compressed air that actuates the clutches and brake assemblies on the three drums, and other controls. The drum closest to the engine raises the 120 ft. boom, the others handle the two load lines.

Beside the engine house on the turntable there is a small structure housing an 8 hp., 1 cyl., 1200 rpm., Sheppard Diesel engine, connected to a Fidelity Electric Co. 5 kw. generator, used for lighting the barge. On the after part of the barge there is another engine house. In the center is a Byron Jackson P-24, Jet, 5 x 14, 4 stage pump, and direct-connected to it on each side are identical Gray Marine Diesels.



Concrete from Rex Paver (background) is delivered to concrete-pumping machine which forces concrete to the pier forms through 8 inch pipes.



This 170 hp. Buda-Lanova Diesel operates the cable drives of the barge crane. It is remote-controlled from adjacent tower.

This power-pump combination maintains a 270 lb. per square inch pressure of sea water on the jet and this water is carried to two jet pipes. These 4 in. diameter heavy steel pipes project down on each side of the pile being driven. They are raised and lowered by cable lines running up over pulleys and down to barge deck drums. Their purpose is to prepare the way for the pile by loosening and boiling up the bottom formation that the pile may penetrate it more easily.

Several large transformer vault boxes, placed in evenly spaced positions under the pier deck and tied into it when the deck is poured, are pre-cast near the casting of the piles, and floated to the pier when fully cured. The Caterpillar Diesel-driven Lorain crane when needed, is brought out alongside the pier on a barge to give assistance.

The manager of the Marine Division of the M. H. Golden Construction Company is "Bob" Golden with the project work under the direct supervision of J. "Al" Golden, and his assistants, Morris F. Landon and "Slim" Anderson.

PAST, PRESENT AND FUTURE OF DIESEL–ELECTRIC LOCOMOTIVES

Here is a clear-cut, down-to-earth and easy-to-read analysis of where Diesel-electric locomotives have come, where they are and where they are going. This splendid contribution to the body of popular knowledge on this subject is taken from a talk by C. R. Osborn, Vice President of General Motors and General Manager of Electro-Motive Division, before the Traffic Club of Chicago and the Mid-West Shippers' Advisory Board in Chicago, January 24th last. Mr. Osborn tells the story factually and most interestingly and he also gives you the facts about Gas Turbines.—The Editor.

IN order fully to understand the tremendous progress which has been made in the use of Diesel motive power throughout American railroads, I should like to sketch as briefly as possible the history of this development. The Diesel locomotive as we know it today did not exist in 1933. It is true that a few switching locomotives and Dieselized trains which we now classify as "rail cars" had been built before this time. However, during 1934, when the Pioneer Zephyr started operations, there was only 2,200 horsepower in passenger locomotives and 5,950 horsepower in switchers placed in service.

In 1933 the railroads of America, in common with all industry, faced a serious situation. As a result of the depression, greater operating economy and better service was urgently required. Competition with other modes of transportation for thinning traffic grew keener, indicating the need for equipment to render more attractive rail service.

In the attempt through the twenties to meet the demand for power that would move even longer and heavier trains on better schedules the reciprocating steam locomotive had been enlarged practically to the limit of permissible weight on drivers, the length that could take curves, and the width and height that could go through bridges, tunnels and stations.

As a result of these and other conditions, the steam locomotive builders had not been able to accomplish very much in the way of product standardization, all of which tended to increase capital investment and cost of operation.

This, then, was the situation in 1933 and it was at this time that a new industry was beginning to take form. Now any industry, to be successful, must have the ingredients for success. We all know what they are, but in our case three very important forces were building up to create a vital new industry.

They were:

1. The resources of the General Motors Corporation and the knowledge and experience of the Electro-Motive Corporation joined forces at about this time.
2. A two-cycle Diesel engine with a very low horsepower weight ratio, designed by Mr. Kettering in his Research Laboratories, showed great promise.
3. The railroads as a result of the depression were vigorously seeking ways and means to reduce operating costs and stimulate their business.

I would like to touch on each one of these briefly.

Electro-Motive had already established itself by 1930, when it came into General Motors, as the most successful builder of gasoline-electric rail cars. In the development of these rail cars Electro-Motive had acquired more knowledge about the application of the internal combustion engine to standard gauge train propulsion than any other organization in the United States.

Most of the Electro-Motive executives were men with a practical background of long experience in the operating departments of American railroads. They knew railroad requirements. They had exhausted the possibilities in the spark ignition engine in railroad motive power. They had been studying the possible use of Diesels for several years and, in fact, had instituted a Diesel study of their own as early as 1927. And, finally, they had the courage of their convictions which had and was to carry them through many very difficult situations.

On the second point, prior to Mr. Kettering's research work, Diesel engines were too heavy, too large, and too expensive to be considered for railroad motive power. Mr. Kettering had been working on a two-cycle engine and a self-contained unit injector system for some years prior to 1932. His two-cycle engine with the unit type of injector had been submitted to every conceivable kind of test including marine installation. It had been designed and redesigned, tested and retested, and by 1933 was ready to go to work on a specific application. Its first assignment, where it had to take on day in and day out work, was the Chicago World's Fair.

Now with regard to the third factor, the railroads' search for a more efficient and economic motive power. Ralph Budd, President of the Burlington, called on Electro-Motive, then located in Cleveland, to find out what they had to offer in motive power for a three-car, light weight, streamlined train he had in mind. He saw this new two-cycle Diesel engine in its interesting state of development and later obtained complete data on its operation at the Fair. Mr. Budd placed an order with Electro-Motive for the complete propulsion machinery for the Pioneer Zephyr.

Drawing on its rail car experience, Electro-Motive designed this machinery and supplied it, obtaining the electric transmission parts from General Electric, and the engine from the Cleveland Diesel Engine Division of General Motors. The story of the Zephyr is widely known history. We and the railroad had many difficulties, but one of the most important contributions to this new industry was the courage and support of men like Mr. Budd who stuck with us in the forward development of this new motive power.

The kind of courage involved was exemplified the night before the famous Dawn-to-Dusk run when the Pioneer Zephyr sped from Denver to Chicago to set a non-stop world record. This train that was to run 1,015 miles non-stop, starting at 5 a.m., was jacked up for replacement of a ruined traction motor bearing in the Burlington's Denver shops at 10 p.m. the night before but the train left and arrived on schedule, thanks to bearing flown from Omaha.

This run and other exploits of the Burlington with the Pioneer Zephyr very clearly established that the Diesel plant could measurably lift the possible schedule performance of a train, and do so at greatly reduced cost. A number of other railroads approached Electro-Motive for

power plants for streamlined trains and some asked for separate mainline Diesel passenger locomotives. Electro-Motive designed a 3600 horsepower two-unit passenger locomotive and farmed out contracts for its construction. This locomotive spent most of 1935 on trial runs on railroads across the country. It demonstrated that the separate mainline Diesel, capable of pulling standard weight and length trains on hitherto unheard of schedules, had arrived.

We, of course, had many serious difficulties during this initial period because the transition of any product from the Research Laboratories to actual use cannot be accomplished without a lot of headaches and trouble. As Mr. Kettering says, "You must use all the theoretical design and knowledge available but, in the final analysis, you have to find out and know what an engine likes before you are sure that you have a good product."

A fourth important ingredient was then added to the other three. General Motors felt that mass production and its essential co-partner—standardization—could successfully be introduced in heavy industry locomotive manufacture. Based on this conviction, a plant site at La Grange was located and purchased and by the end of 1935 Electro-Motive was in a home of its own, covering some 205,000 square feet of floor space. This was less than one-tenth of the present floor space.

The density of the map of Diesel passenger and freight routes at the end of 1946 was getting very close to duplication of the routes of the principal Class I railroads of the United States.

Now why have the railroads supported this new enterprise to the extent that today we have over 1,300 freight units, 500 passenger units, and a thousand switchers in service The mainline locomotives alone are handling approximately 20 per cent of the passenger train mileage and 12 per cent of the gross ton miles of freight on Class I railroads. It is the direct result of the availability—reliability, and economy of the Diesel engine.

We could introduce instances and statistics proving these statements the rest of the afternoon. Most of you could cite instances. But to refresh your recollection I will cite just a few figures and case examples covering some of the major advances directly traceable to the advent of Diesel mainline power. The national all-time availability record of all our locomotives in service, freight, passenger, and switcher is around 92 per cent.

The most obvious lift in railroad standards has been in schedules. We go from Chicago to the Pacific Coast in thirty-nine and three-quarter hours, which is ten hours faster than the fastest schedule ever made with steam, and seventeen hours faster than the fastest schedule when Diesel was first introduced. In freight service the Burlington moves long heavy trains from Chicago to Denver a day faster than formerly with steam.

The reliability of this power is widely known. Some railroads report an "on time" record of 97 per cent over the past twelve years.

The high initial tractive ability of the Diesel, which eliminates bunching in both freight and passenger trains made possible the new standard of passenger comfort that goes with tight-lock coupling and the lessened damage to lading that goes with smoother handling of freight.

And then there is the very important item of cost of operation. On some railroads, depending upon the cost of coal, we have reduced fuel costs as much as 60 per cent. I noticed the other day a financial report of a large railroad which broke up their revenue dollar into various items of expense and operating profit. This railroad, if it were using Diesels, would be able to cut its fuel bill to the extent that the savings in fuel costs would more than equal the amount of money available to the stock holders, the owners of the business. Many railroads have reduced their maintenance costs of motive power by more than 50 per cent.

Standardization of parts of Diesel locomotives has provided many advantages for the railroads, beyond the fact that it enables the railroads to get better locomotives at lower cost. Few realize to what lengths we have carried this standardization. For instance, pistons and traction motors are interchangeable whether used in the switcher, streamliner, or freight locomotive.

And then, again, we cannot overemphasize the service to the customer which is so important. I believe the national average on the movement of freight trains with steam power is 17 miles per hour. A number of railroads using Diesels, average from 24 to 30 miles an hour. That railroad which is averaging 30 miles per hour, day in and day out, improved its performance on freight movement about 76 per cent against the national average.

Without question we are in a period of rapid spread of the application of Diesel motive power. And I think it is equally unquestionable that we are headed toward complete Dieselization of many railroads and complete Dieselization of most divisions of the rest.

But the most important development in the future will begin to unfold after whole railroads or whole divisions have been Dieselized and it is possible to start collecting on the corollary benefits or to put it another way, after it is possible to get rid of the expensive supporting services of steam. These economies, over and above the saving on operation and maintenance of Diesel locomotives, include the reductions made possible by elimination of coal hauling, handling and storage, ash dumping and removal, water pumping, treatment and storage and finally the far more extensive servicing and repair facilities required by steam locomotives. This sums up my remarks on the growth of the Diesel locomotive.

Now, so much has been said about the gas turbine obsoleting the Diesel engine that I think we might spend a few minutes discussing this possibility.

We must, of course, take advantage of every new development to insure that we realize the maximum economy and reliability in our locomotives. Not only must we keep abreast of new developments, but we must push aggressively forward on any new design or idea which appears to have merit.

The gas turbine does have merit in many respects.

1. It replaces all reciprocating parts with rotating assemblies, with associated benefits in manufacturing and operation.
2. The space occupied is relatively small and its specific weight is less, compared with a Diesel.
3. It appears possible to use a lower cost fuel.
4. Lube oil consumption should be substantially reduced.
5. It requires no water.

On the negative side, there are problems of design and operating characteristics, some of them serious, which must be solved.

1. Perhaps the most serious is the lack of known materials which will stand up within the heat ranges where the turbine operates most efficiently. Gas turbines must be operated within very high temperature ranges to realize satisfactory thermal and mechanical efficiency. With the known materials we now have the heat range must be reduced to the extent that efficiency suffers and does not

. . . . *And now please turn to page 79* . . . .

DOCTORS DEMAND DIESEL

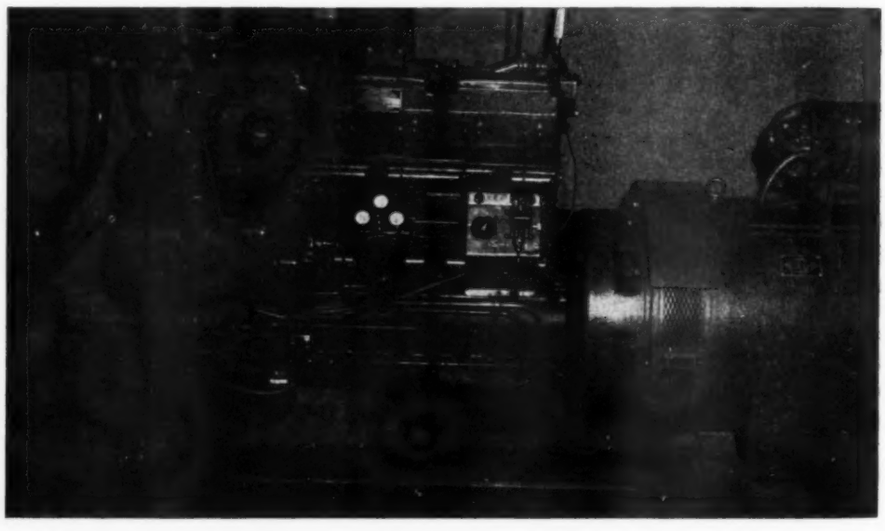
"SMOOTH power"—that is what doctors and technicians at the Evangelical Deaconness Hospital in St. Louis call the electrical current produced by a Diesel-driven generator set in use at the hospital. Doctors and technicians say they can tell when the Diesel-driven generator is on by the smooth, unwavering current it produces, and they demand it whenever they are ready to use a piece of technical equipment such as the electrocardiograph or the fluoroscope. A Cummins Diesel engine was installed at the hospital in May, 1945, to assist two steam-driven generator sets and to provide an isolated standby source of power. Exceptionally heavy current demands at certain periods of the day were overloading the steam-driven sets. The Cummins Diesel engine is driving a 50 kw., 62½ kva. single-phase generator which is used in conjunction with the steam generator plant. The Diesel-driven generator teams up perfectly with the steam unit.

In addition to working alongside the steam-driven generators on the ordinary day's work, the Diesel-driven unit has another important function in the hospital. But let Mr. Groenemann, who is president of the National Association of Power Engineers, tell about that phase of the work:

"Even the doctors and the technicians in the hospital can tell when the Diesel is furnishing the power; the current just doesn't waver. When they want to use the electrocardiograph. the fluoroscope, deep therapy or X-ray equipment, they will phone down to the boiler room and ask me to put on the 'smooth power.'"

Installation of the Diesel-driven generator which operates about 12 hours a day, did away with the necessity of having battery-powered standby lights in the hospital. "There was a breakdown in the steam generating unit not long ago," Mr. Groenemann pointed out, "but thanks to the Diesel there was no interruption of current. You know, in a hospital the lights must stay on."

Vibration and noise must be held to a minimum in any hospital installation. The Diesel at the St. Louis hospital was mounted on a special cork base, eliminating any vibration and unnecessary noise. Another outstanding feature of this installation is a method of recapturing and using the engine heat. Engineers have calculated that this engine is operating at an efficiency of 72 per cent. This remarkably high degree of efficiency is achieved by taking the water, after it has cooled the cylinders of the engine, and passing it through a Maxim Silencer Waste Heat Boiler. Heat from the exhaust converts the already hot water into steam, which goes directly into the main exhaust heating system with the steam from the steam engines.



(Below) The Evangelical Deacconness Hospital, St. Louis, Mo. (Above) Cummins 50 kw. Diesel generating set which operates twelve hours a day.

ELECTRO OPTICAL PYROMETER

By JIM LARSEN

BETTER high-explosive fuels may result from Diesel research now being conducted at the University of Wisconsin with the aid of an electro-optical pyrometer, a device invented by Wisconsin engineers and believed to be the only one of its kind in existence. It is entirely possible that the engines of the future will be designed around the new fuels which engineers can now develop with the pyrometer. It is giving engineers the answers to questions concerning the fuels used in combustion engines which have not only baffled them for years, but which, it is hoped, will bring greater efficiency and power into the operation of the Diesel trucks and locomotives of tomorrow, and of the automobiles and jet-planes of the future.

"We are studying the performance of different fuels in internal combustion engines," said Phillip S. Myers, mechanical engineer, "particularly in regard to their molecular structure and the combustion process; the temperature and pressure of the exploding gases within the cylinder." Experimenters working with combustion engines have always encountered difficulty obtaining temperature and pressure readings of conditions within a cylinder. This is because the explosions take place at an extremely fast rate, and are inaccessible to ordinary instruments.

A single cylinder Diesel engine has been used at the University of Wisconsin for the combustion experiments operates at about 1,200 revolutions per minute, not an unusually high speed, and has 600 explosions per minute or ten per second. During each explosion the temperature within the cylinder may rise from 200 to 5,000 degrees Fahrenheit, and the pressure to 1,200 pounds per square inch. Both events take place from 1/3000 to 1/5000 of a second. Exact measurements concerning both are a necessity to an understanding of the operating efficiency of different fuels. Methods in existence when the project was started in 1942 would not give the engineers the accurate measurements of temperature and pressure they needed. The electro-optical pyrometer was the answer to their problem. It took two years to develop, with four Wisconsin mechanical and chemical engineers working on the new device; Otto A. Uyehara, Phillip Myers, Dr. K. M. Watson, and Prof. L. A. Wilson.

"We believe the instrument we've worked out is the only one of its kind," Uyehara said. "It will take a continuous temperature recording from the time the fuel in the cylinder starts to burn until it stops. In addition, by the use of a drive shaft cam, the temperature and pressure recordings can be related to the position of the piston," he said.

An oscillograph records the instant at which the fuel ignites, the phase of the piston cycle, the length of time fuel was injected into the cylinder, the temperature and the pressure. A special camera simultaneously records all four at any instant. The pyrometer operated on the known principle that the intensity of certain wave lengths of light given off by a luminous flame are indicators of flame-temperature, but previously this principle had only been applied to flames that were constant. Those with a flash of less than 1/10 second posed a considerable engineering problem. The light from the explosion within the Diesel cylinder is "seen," by photo-cells through an ingenious quartz window in the cylinder wall, after first being broken into a spectrum by a series of lenses and prisms. Light beams of two selected wave lengths are directed into two photo-electric cells. The cells respond instantly to variations in the light intensity, corresponding to the temperature of the combustion process. An oscillograph records the temperature, or rather the impulse aroused in the photo-cell by the flash of the explosion, which can then be photographed.

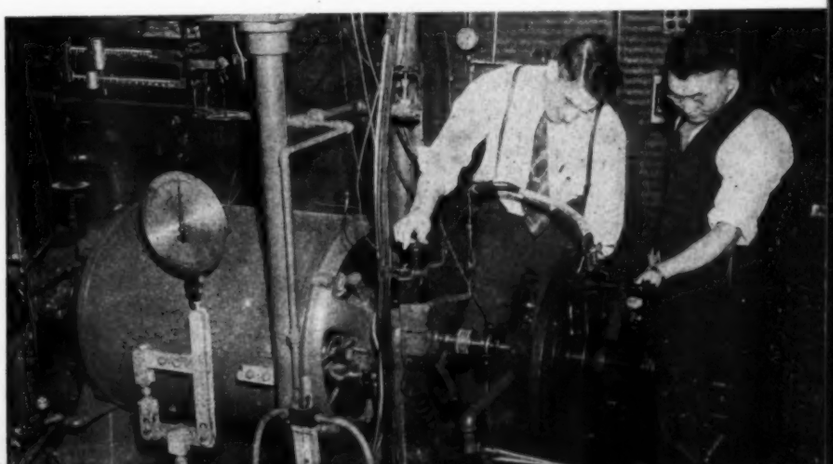
The pressure indicator consists of a diaphragm of a particularly strong and heat-resistant metal, Iconel, which retains a high polish under extreme temperatures. This diaphragm, also inserted in the cylinder wall, reflects a beam of light in a manner which will indicate the variation in pressure during the explosion, and another system of lenses and mirrors amplifies the light variation caused by the bulging of the diaphragm under the cylinder pressure.

"Inefficient combustion is sometimes caused by the time-lag between the moment the fuel is injected and the moment the explosion begins —which means that at high speeds the piston may be on the return cycle, causing a loss of power and speed," Myers explained.

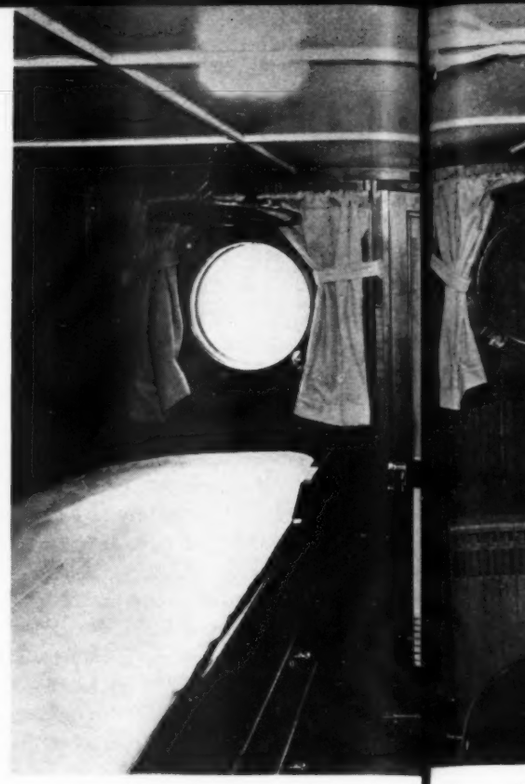
"What we hope to do is design a fuel which will give better performance in Diesels. We're also now expanding the research to include spark ignition engines and their fuels, so perhaps we'll be improving the performance of both types, said Uyehara. "Already we have obtained a number of special fuels, and expect to work with many more," he added. "The research should give engine manufacturers some efficient, powerful fuels around which to build their new engines."

Closeup of Diesel shows indicating equipment used in determining temperature and pressure within cylinder. Quartz "window" is seen in operator's left hand.

Myers and Uyehara inspect the cam and photo-cell which relate the piston position within the cylinder to explosion temperature and pressure at various points in engine cycle.



NEW 1200 H. P. TEXACO DIESEL TUG



Master's stateroom aboard the "Havoline."

NOT only did The Texas Company recently receive a powerful new tug at its Port Arthur, Texas, terminal, but this well known oil concern has eight other Diesel-engined towboats operating in this southern locality and near-by waters. Transporting oil requires tankers and barges as haulage by water is the cheapest form of petroleum transportation. To move big floating oil carriers at docks and to tow tank barges necessitates tugs, as well as smaller harbor craft for general service. To propel their fleets, oil companies have been large users of Diesels for about thirty years as they believe in the policy of economy even when there may be a temporary surplus of fuel oil.

Because of the need for extensive transportation facilities, American oil companies have long been builders of ships. In fact, during the ten-year period from 1930-40, many of the shipyards of the United States may have had to be closed down had it not been for tanker orders. In that period of dull national business, the petroleum industry built 90 tankers aggregating 1,214,442 deadweight tons. In the same period, only 322,279 tons deadweight of passenger ships and 504,224 deadweight tons of freighters were completed.

Trials of the *Havoline* as this new Cleveland Diesel-engined Texaco tug is named, were regarded sufficiently important to attract a representative gathering of marine and industrial officials from local and distant cities, including George W. Codrington, vice president, General Motors Corporation, and also general manager of the Cleveland Diesel Engine Division. Mr. Codrington, once a ship's chief engineer, takes a personal interest in all craft equipped with General Motors engines.

Among others aboard the *Havoline* when speed and manoeuvering tests were run on the ship canal at Port Arthur, Texas, were: Captain C. L. Hand, manager, marine department, The Texas Company; Frank Wallace, general works manager of the Texaco oil refinery at Port Arthur; F. H. Holmes general superintendent of the refinery; H. J. Le Blanc, president, Standard Brass & Mfg. Co., Port Arthur; and Howard Perkins, manager, Big Three Welding Company.

The captain of the M. T. *Havoline* is F. J. Dobbertin, and Henry Beal is her chief engineer. The builders of the hull—Gulfport Boiler and Welding Works, Port Arthur, were represented by Bruno R. Schulz, president, and E. W. McCarthy, vice president and chief engineer.

The trials were eminently successful, regardless of the fact that the main engine and reversing mechanism were given a strenuous handling during the reversing and full speed ahead tests. The complete absence of trouble and of vibration under this grueling run was impressive, and will be important under regular operating conditions.

The *Havoline* is the most powerful of Texaco's Diesel fleet at Port Arthur. The Gulfport Boiler and Welding Works has done a good job constructing the all-welded steel hull as well as installing the machinery. The tug's length is 102-ft. 2-in., by 24-ft. beam, with a depth of 12-ft. 4-in., and 10-ft. 6-in. draft aft in loaded condition. She is classified to American Bureau of Shipping's highest standard of workmanship.

The propulsion machinery of the *Havoline* consists of a Cleveland Diesel marine engine of 1,200 bhp. connected to an 814-kw. 560-volt, 1454-amp., D.C. generator, and turns at 750 rpm., when operating at full load. This Diesel-generating unit furnishes current to an electric propelling motor turning at 875 rpm., and connected to the propeller shaft through reduction gearing. The manganese bronze propeller is 8-ft. 10-in. diameter by 7-ft. pitch; is three-bladed, right-handed and turns at 200 rpm. free running and develops full torque and power at 160 rpm. towing. The gearing is of the single-reduction, single-pinion type and incorporates the thrust bearing. The shaft has a diameter of 9⅞-in. Engine control is from the pilot house, as well as in the engine room when desired. Duplicate control is arranged alongside the after steering wheel.

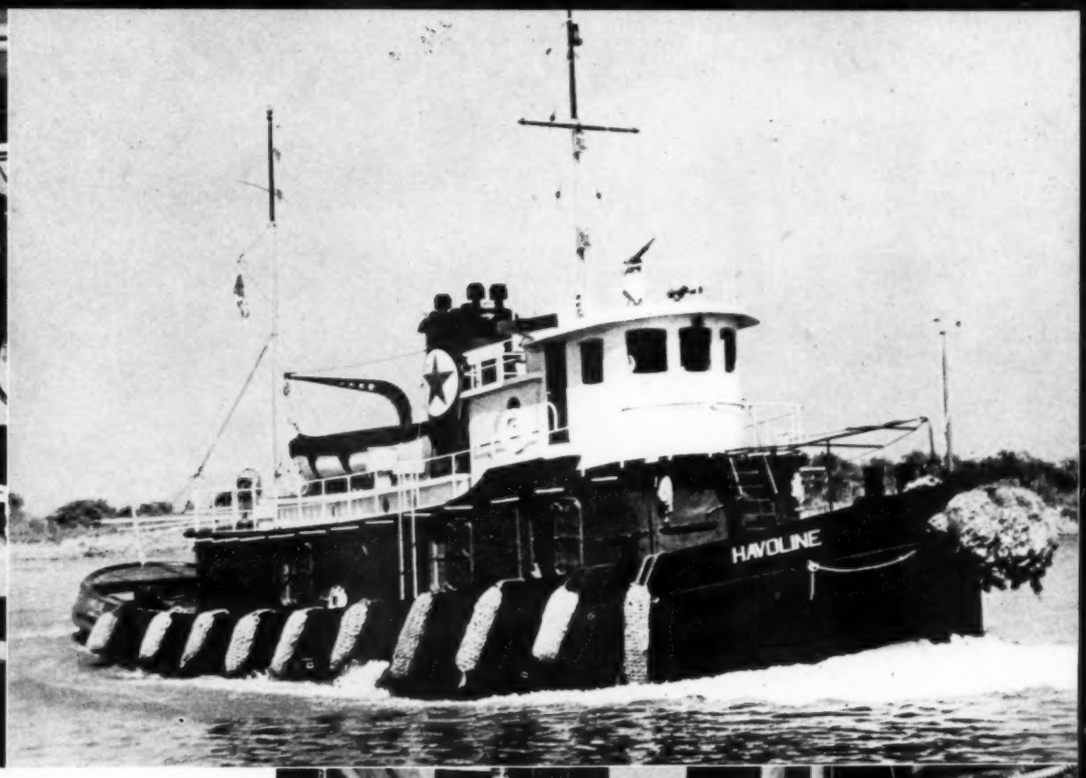
The main engine starting system consists of a starting contactor unit, push button control, special starting winding built into the generator, and a 32-cell, 64-volt electric storage battery. The latter is one of two batteries, and the second being a 200-amp, hour lighting battery of 56 cells in lead-lined boxes.

For auxiliary power there is a 30-kw., General Motors Diesel-generator set of the D.C. type. There also is an 110-volt A.C. motor-generator which can be connected with a shore transmission line when the tug is alongside a dock, enabling the various service pumps to be operated without running the auxiliary Diesel.

There is a 5-hp., 90-gpm., 50-lb. pressure lubeoil pump; a condensate pump for the heating plant; a 200-gpm., fire and general service pump driven by a 20-hp., motor; a bilge pump driven by a 7½-hp., motor; a rotary type 50-gpm., fuel oil transfer pump driven by a 3-hp., motor; a 395-gpm., fresh water pump; a salt water 395-gpm., pressure pump, and a hand-operated emergency pump. There also is a 200-psi., air compressor—electric motor driven.

Part of the deck house structure forward and on the port side of the galley contains a Frigidaire of 20 cu. ft. capacity with wall type freezing unit. An average of 40 degs. can be maintained when the outside temperature is 110

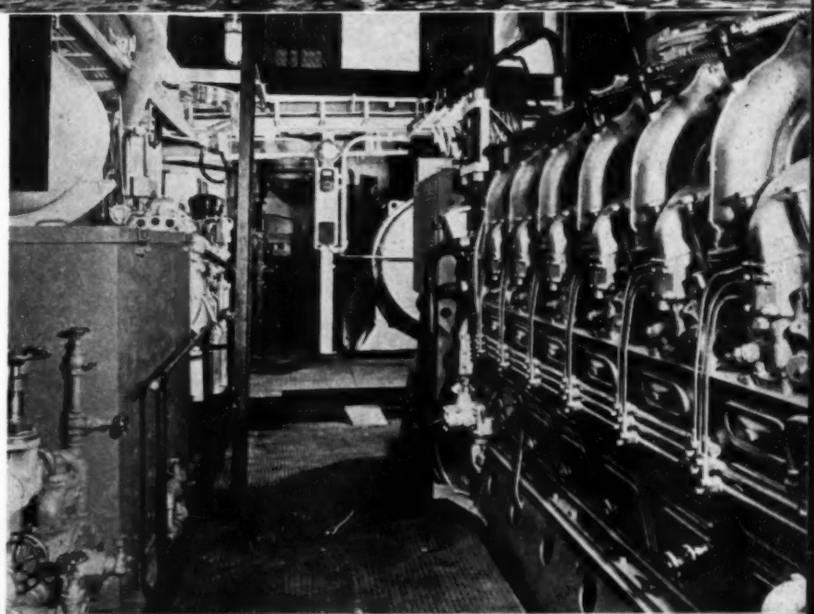
Comfort is not overlooked.



View of the "Havoline," the Texas Company's new Diesel tug which develops 1200 bhp.

degrees F. Another unusual feature is a 20 cu. ft. quick freeze unit in the galley.

Accommodation is provided for a crew of thirteen officers and men, and includes six lavatories, two showers and two toilets. The complement consists of captain, two mates, one cook, chief engineer, two assistant engineers, three oilers and three deck hands. There are six berths, a settee and a table in the forecastle. Above the forecastle on the main deck are two cabins, one with a single berth for the use of the cook, and the second with two berths for the first and second mates. Next in line is a combination galley and mess room, the galley being equipped with oil fired range and the usual utensils, as well as a large dining table.

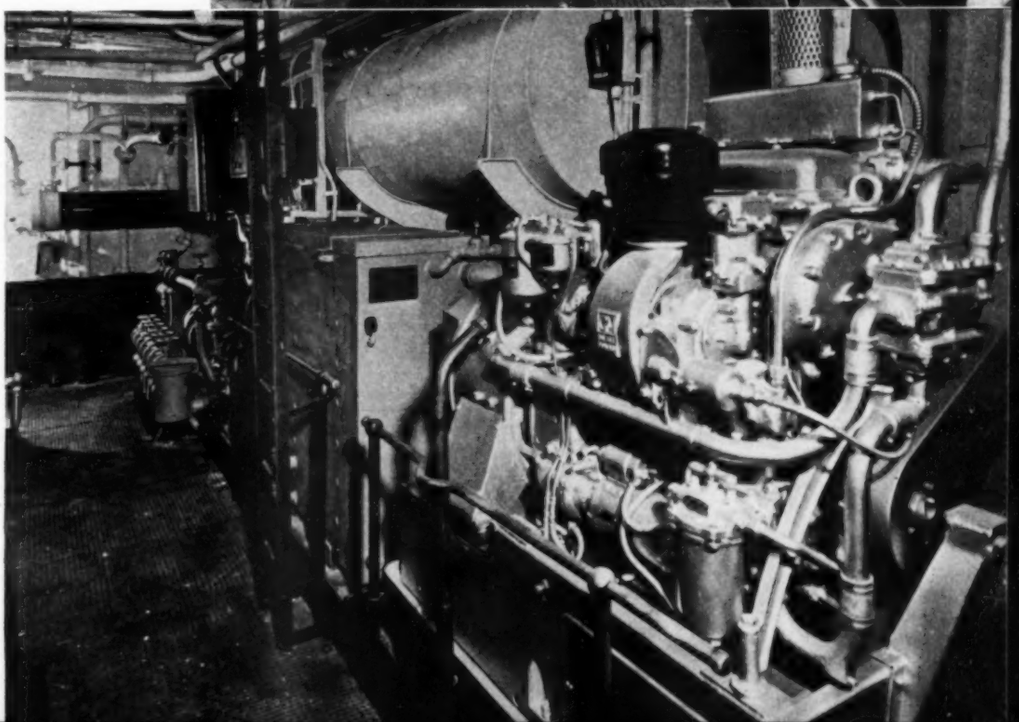


"Havoline's" 12 cylinder, "V" type General Motors Diesel develops 1200 bhp.

Auxiliary power for the tug is supplied by this 30 kw. Diesel generating set supplied by General Motors.

Ship to shore telephone has been installed for communication between the owner's operating department and the tug's captain, which increases the general efficiency of the vessel. For ventilating the crew's quarters, there is a blower of 1,500 cu. ft. capacity in the upper part of the engine room, with ducts leading the air to the forecastle through the galley. To ventilate the engine room, there is a blower of 9,000 cu. ft. capacity driven by a 5-hp., motor through a speed reduction of 3.7:1.

The *Havoline* has been built staunchly to last several decades, and to operate with full power efficiency during her lifetime. Doubtless she is a proud ship that will live up to her job wherever it may be.



DIESELS . .

SPOTS of civilization are few and far between in the desert country of our western states. Until the coming of the modern highway and automobiles these dry expanses were traveled only by the gold-hungry prospectors. Now however tiny communities have sprung up along the through routes to serve the needs of the American Motorist during his vacation travels. Most of these stopping places are well equipped to handle the needs of the wayfarer and it is indeed amazing to consider the changes which have taken place which have made these wayside communities self sufficient in so many ways. The development of low cost, dependable power through the use of Diesels has aided greatly in this change.

Two busy little roadside communities, situated on the rim of the famous Bonneville Salt Flats where many of the world's brightest stars of the automotive speed firmament performed, have proved the ability of the Diesel engine to help bring modern living to isolated places.

As a matter of fact, the brilliant electric sign on the State Line Hotel at Eastline Townsite,

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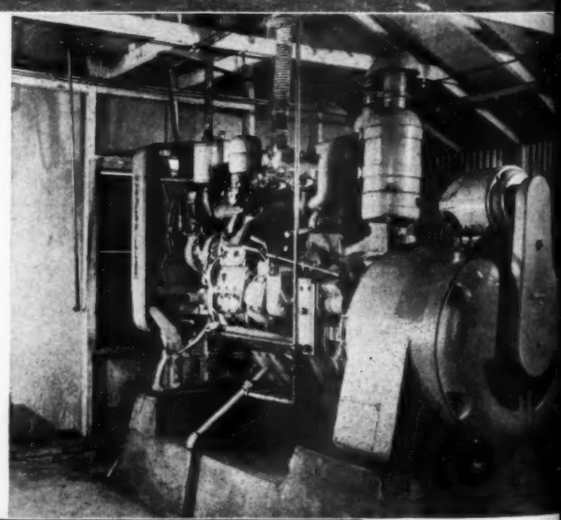
(Top) A group of buildings in the busy little roadside community of Wendover, Utah.

(Left) The modern waiting room of the bus depot.

(Right) One of the two Caterpillar Diesel generating sets which furnish light and power for most of the buildings in Wendover.

(Lower) A dramatic night view of the station and cafe at Wendover.



S. . . IN THE DESERT

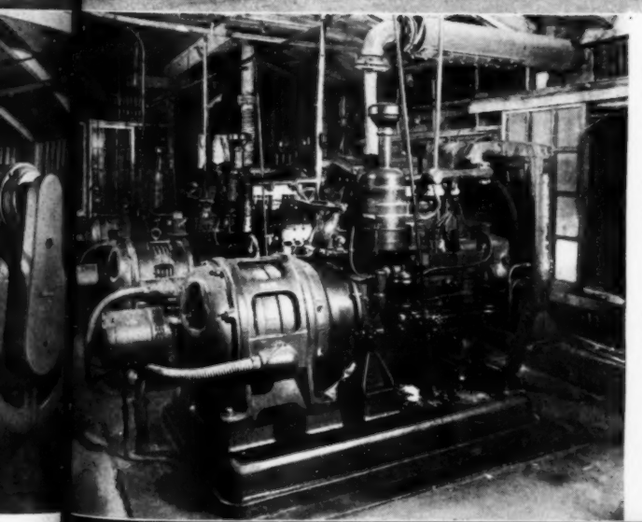
Nevada, can be seen for a good ten miles at night, beckoning the traveler to its air-conditioned comfort.

W. F. Smith's State Line Service Station at Eastline Townsite has long been a host to speedsters who came to the Great Salt Lake Desert in search of fame and glory, thumbing their noses at danger. Some years ago he installed two Caterpillar Diesel engines to replace a miscellaneous assortment of power producers and later added another Caterpillar when more power was required for the job.

The three engines supply all light and power for the little community. The engines are direct connected to 25 kw. Westinghouse generators and operate 24 hours a day on full loads which average 45 amps during the daytime, 65 amps at night and as high as 85 amps in the summer when the air-conditioning is functioning to kill the stifling heat.

Meanwhile, across the Nevada-Utah border line, two Caterpillar Diesel-electric sets furnish light and power for most of the buildings in the community of Wendover, Utah.

The engines operate alternately on a 24-hour schedule, supplying 22 stores and buildings. Before the second electric set was installed in October of 1945 the original set, installed in November, 1943, operated 15,405 hours and was shut down for only three hours during that time with the exception of time devoted to routine inspection, adjustments and oil changes.



(Top) The principal buildings in the community of Eastline Townsite, Nevada.

(Left) Three Caterpillar Diesels supply all the light and power for the town. They average 45 amps during the day, 65 amps at night.

(Right) Some of the homes which make up the small community of Eastline Townsite, Nevada across the state line from Wendover, Utah.

(Lower) The State Line Hotel's brilliant sign is seen 10 miles away.

DIESEL ELIMINATES FIRE HAZARD

THE Valentine Clark Corporation of Minneapolis has stopped worrying about fires at least as far as their lumberhoisting machine is concerned. Their self-propelled Brown Hoisting Machine was formerly powered by steam and utilized a five by nine foot boiler which was constantly showering sparks around the yard. Moreover the company required the services of a boiler tender 55½ hours a week just to keep the steam up. Recently the company had a General Motors Diesel installed. This new Diesel, 4 cylinders, 90 bhp., occupies only a fraction of the space formerly required by the steam boiler and permits instant power instead of the slow firing of the boiler to raise a head of steam.

Also used as a locomotive in moving flat cars about the yard, the Brown Hoisting Machine has a capacity, at a 16 foot radius, of 24,100 lbs. A Brown Lipe transmission coupled to the engine is geared with three forward speeds and one reverse. Gear ratios of the forward low speed and reverse are both 7 to 1, allowing the machine to go at the same speed in either direction.

Brown Hoisting Machine loading 50 ft. poles on flatcar. The General Motors Diesel is seen mounted at rear of carriage.

BOSTON DIESELS OBEY PARKING LAWS

WITH five new Alco-G.E. 44-ton Diesel-electric locomotives replacing three "Climax" steamers, Boston's charter railroad, the Union Freight Railroad can now flexibly operate trains in compliance with city ordinances and road limitations. Granted an irrevocable charter in 1872, the Union Freight Railroad serves as a connecting line between Boston's North and South stations, along busy Atlantic and Commercial Avenues. Its 2½ miles of track handle an average of 5500 cars per month for the New Haven, Boston & Albany, and Boston & Maine railroads entering and leaving the city as well as service to 230 consignees along the right-of-way.

City ordinances impose some unusual operating restrictions. Between 7:00 a.m. and 7:00 p.m. train length is limited to 15 cars. The Union Freight handles these trains with a single 44-ton Diesel-electric locomotive. From 7:00 p.m. to 7:00 a.m., with a 35-car train limit, two 44-ton units in multiple handle the job easily.

Speed is limited to about three miles per hour, because trains must always be preceded by a man on foot, carrying a red flag during the day and a red lantern at night. Trains must give right-of-way to fire engines, police cars, ambulances, and all other emergency vehicles. Cross streets must never be blocked.

The Northern Avenue Bridge at the entrance to the New Haven freight yards presents the greatest load restriction of the entire Union Freight system. Maximum allowable load on the span is 90 tons. The two 44-ton Diesel-electrics, however, operating in multiple, clear the bridge with a 2-ton safety margin. Maintenance of the new Diesel-electric locomotives, when necessary, will be performed at the Union Freight Railroad's own engine house.

New Alco-G.E. Diesel-electric locomotive in Boston.

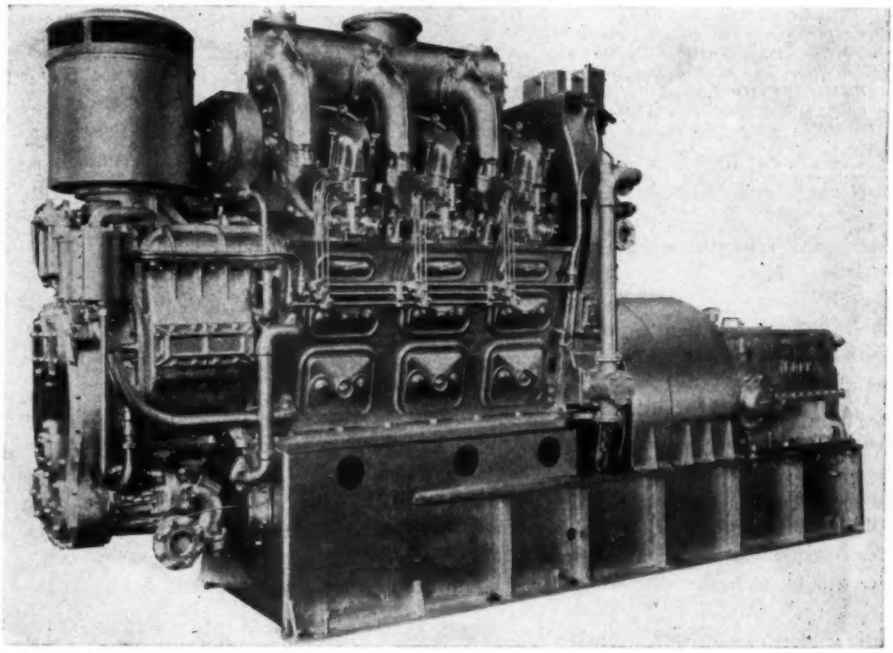
NEW DIESEL TUG FOR MORAN

THE wooden tug, *Joseph H. Moran II*, has recently been added to the towing fleet of the Moran Towing Company, New York, N. Y., and is of particular interest because no auxiliary engine power is required for ship services when she is under way. The *Joseph H. Moran II* was built at Cambridge, Md., by Cambridge Shipbuilders, Inc., from designs by Eads Johnson, naval architect, New York, N. Y., for general towing service. She is 85 ft. 9 in. long, by 21 ft. width, and 9 ft. draft, and is 115 tons gross. Construction is of white oak frames, keel and stem with yellow pine planking.

Driven by V-belt off the blower shaft at the forward end of the main engine is one 10 kw., 120 volt, DC, generator equipped with voltage regulator, and this little unit takes care of all lights, etc., when the tug is in operation. Consequently, her 20 kw. auxiliary Diesel-generator unit is only used when the main engine is shut down. For ship's heating there is a low-pressure gravity system supplied by an oil fired steam boiler.

Her main engine is a Cleveland Diesel of 600 shp. at 750 rpm., driving an 84 in. diameter bronze wheel at 253 rpm. through an air-flex clutch and reduction gear. The propeller shaft has a diameter of 6¾ ft. In the engine room, in addition to the usual service and engine pumps, switchboard, etc., there are two starting-air compressors for the main engine, and one 56 cell, 110 volt, 209 amp. hour storage battery for starting the auxiliary Diesel engine-generator set. The main fire and bilge pump is driven by a 3½ hp. motor. The steering gear is of the worm gear type operated by a 7½ hp. electric motor.

There are two staterooms arranged in the forward part of the 40 ft. by 12 ft. by 7 ft. deck house. In the same deck house are the galley, upper engine room, two more staterooms (aft), toilet and shower. The staterooms each have two pipe bunks, wash basin, two steel lockers and a chair, while the galley is equipped with an oil-burning range, dresser, oak table and built-in refrigerator of 20 cu. ft. capacity. The pilot house is 9 ft. by 9 ft.



Developing 600 shp. at 750 rpm. General Motors Diesel drives "Joseph H. Moran."

85 ft. tug "Joseph H. Moran" another of the Moran fleet to boast Diesel engines.

STANDARD PRACTICES FOR DIESEL ENGINES

Chapter 5 & Chapter 6 (in part)

Editor's Note: The following article is reprinted from the fifth and sixth chapters of the newly revised book "Standard Practices for Low and Medium Speed Stationary Diesel Engines" which was recently published by the Diesel Engine Manufacturers Association. Other chapters of the book will be reprinted in succeeding issues of DIESEL PROGRESS. In answer to a growing demand for the revision of the 1935 edition, this book was published. It includes the refinements, new developments and changing procedures that have marked the advances of Diesel engineering in the past ten years. The aim of this book is to be of service to Diesel engine users, prospective buyers and consulting engineers. It covers stationary Diesel engines operating at speeds up to and including 750 rpm. The book is available to readers of DIESEL PROGRESS at the price of $2.75 postpaid. Order your copy today from DIESEL PROGRESS, 2 West 45th St., New York 19, N. Y.

Torsional Vibrations and Critical Speeds

TORSIONAL vibrations occur in any power unit consisting of a reciprocating engine connected to some driven equipment. At certain speeds these vibrations may become excessive due to the force impulses causing these vibrations being in resonance with the natural frequency of the system. These speeds are called critical speeds and are evidenced by noisy operation. Continuous operation at these speeds is undesirable and often dangerous.

These critical speeds are at entirely different points and have no relation to the critical speeds which may exist in either the engine or driven member alone. Some of the forces which cause these vibrations come from the engine, but others, just as effective, may come from the driven equipment, especially if this is of a reciprocating nature.

It is possible to calculate the speeds at which these criticals occur, and also the magnitude of the vibrations, if certain data concerning the engine, the driven equipment, and all connecting parts are known.

In most cases it is possible for the engine manufacturer to change the speeds at which these critical speeds occur by minor alterations to the engine or connecting member between the engine and the driven equipment so as to avoid the operating speed of a constant speed unit; or, in the case of a variable speed unit, to keep the operating range as free of critical speeds as possible and advise the purchaser at what speeds criticals do occur.

It is seen, therefore, that the successful operation of the unit depends on the proper handling of this matter. Engine builders have, on this account, made it their practice to make these calculations not only when they furnish the entire equipment, but also when a portion of the equipment is furnished by the purchaser, provided the purchaser furnishes the engine manufacturer with the necessary accurate data concerning these parts. When the Diesel engine manufacturer furnishes the entire unit he assumes the responsibility of making such minor changes as are necessary so that in the case of a constant speed unit, no harmful torsional vibrations will occur within 10 per cent above or below the normal operating speed and to keep the operating range of a variable speed unit as free of torsional vibrations as possible.

In case part of the equipment is supplied by the purchaser, the Diesel engine manufacturer will assume the same responsibility as to critical speeds, as if he had furnished the entire assembly, but only to the extent of calculations based upon such accurate information and data as are supplied by the purchaser.

The driven equipment may consist of a wide variety of apparatus such as generators, exciters, reciprocating pumps, rotary pumps, gears with the necessary connecting shafting, couplings, pulleys, etc., and each element and its relative location has its effect on the location and magnitude of the critical torsional vibrations. It is, therefore, essential that detailed information applying to each driven unit be supplied to the engine manufacturer such as exact WR^2 and location of related parts, nature of mounting of these parts on shafting, shafting sizes, shafting material, flexible characteristics of couplings, weights and particulars of reciprocating parts. The accuracy of the results of the engine manufacturer's calculations depends upon the accuracy of the information supplied to him and obviously his responsibility is limited accordingly. If alterations are required after the order is placed, due to inaccurate or incomplete information, these shall not be made at the expense of the engine manufacturer and he shall not be held responsible for any delays caused thereby. It may be found desirable or even necessary to change the customer's proposed arrangement of, or to modify certain parts of, the driven equipment such as shaft sizes, weight of flywheels or counterweights, and in certain cases some form of torsional vibration damping device may be required. The additional expense shall not be borne by the engine builder.

The purchaser should not alter the arrangement of the driven apparatus, add any additional equipment to, or remove any equipment from a unit without consulting the engine manufacturer as to the effect on the location of critical speeds, as any change of this nature might change the location of the critical speeds so as to bring one or more within the operating range of the unit. It is likewise evident that the operating speed of a unit should not be changed without consulting the engine manufacturer, as the new speed might coincide with one of the critical speeds or come close enough to it to be dangerous.

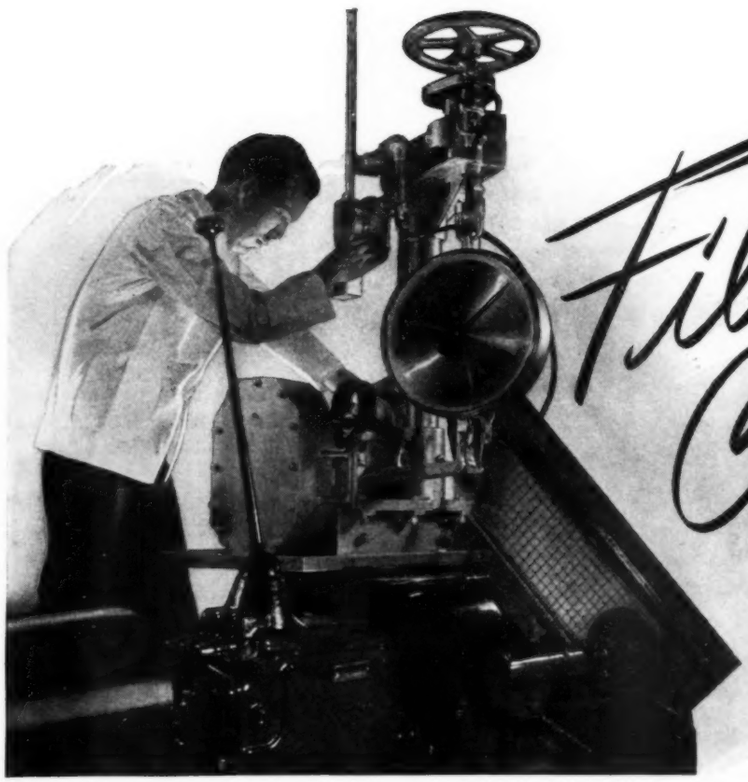
CHAPTER SIX

Intake and Exhaust Systems

The Intake System.—This consists of a duct for leading the combustion air to the engine manifolding from the chosen point of induction, together with such air cleaning and air column oscillation damping apparatus as may be required. Most Diesel engines perform better with a well designed inlet system than with individual direct inlets to the cylinders, since the velocity head acting toward the engine is maintained without total interruption throughout each cycle.

Since Diesel engines, four-cycle and two-cycle, use between two and five cubic feet of air per minute per rated horsepower, the effect of locating the air intake inside the building is readily estimated in the ventilating engineer's terms of "changes of air per minute." Even for power plant buildings in warm regions, the volume of air required for the larger engine installations may be too great to allow proper control of ventilation if taken from inside the

. . . . *And now please turn to page 74* . . . .



Film Censor

The alert technician in the illustration is censoring film—the strength of film in Sinclair industrial lubricants designed for protection of your valuable machinery.

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building. Hot ground air so taken in during the hot part of the day may cause overheating of the building. In such cases it would be more desirable to depend upon natural ventilation through roof ventilators and to take the intake air from outside the building by a suitable duct. In cold country it is impracticable to heat the full quantity of intake air. Consequently it is almost universal practice to draw air from outside the building, except in the case of relatively small engine installations or where the power plant occupies but a fraction of a large building space which is adequately supplied with heating and ventilating equipment.

The establishment of a resonant intake pipe length for the purpose of producing "ramming" or mild supercharging effects is not common. Unless developed by careful experiment the results are more than likely to be indifferent or unfortunate. Critical oscillations of the air in the intake may be extremely annoying, causing not only excessive induction noise but also echoes from adjacent sound obstacles and mechanical vibration of buildings. The aim usually is to damp oscillation.

Intake ducts should not be too long. It has been common practice in the past to state in engine instruction books that piping for any

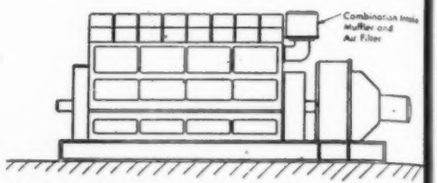

Fig. 6. Method of Installing Intake Muffler and Air Filter.

of the engine services should be of the size indicated by taps or flanges on the engine when runs do not exceed a stated distance. This had its foundation in experience with engines of the past. However, the range of cylinder multiples and speeds offered by engine builders today calls for advice which is better founded on the established theories of vibration in air columns. Therefore the engine manufacturer should be

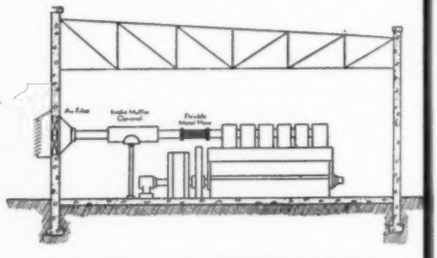

Fig. 7. Another Method of Installing Intake Muffler and Air Filter.

consulted in designing the intake system. The system should include air intake mufflers where local conditions require low noise levels.

All intakes should be provided with some form of air cleaner whether dry type, oil bath, viscous impingement or electrostatic. While average air pollution varies greatly in different sections, any area is liable to occasional excessive dry precipitation and provision should be made for it. When the air cleaner is also effective as a muffler, it becomes a valuable adjunct to a well designed inlet system.

Where turbo-blower superchargers are used they are sometimes fitted with an inlet screen and acoustic silencer by the maker. If remote intakes are required, special advice should be secured from the engine builder.

The mass of inlet pipe should be isolated from the engine by use of suitable flexible connection, where necessary.

Light weight steel pipe and fittings may be used for the intake system. Flanged bent pipe with long radius turns make a sightly and efficient job, readily available since pipe bending and welding contractors are easily found.

DO YOU KNOW THESE

3 THINGS

ABOUT ALUMINUM FOR DIESEL ENGINES?

Many a diesel builder or user knows one, or two, of these major Alcoa Aluminum advantages—and takes advantage of them.

But unless you know, and take advantage of *these three*, you are not getting top diesel performance. And other characteristics of aluminum can give you a "bonus".

When you think of aluminum for diesel improvement, it's natural to think of Alcoa. For Alcoa's diesel experience extends unbroken from the first use of this metal in diesels more than twenty years ago, and offers real help in problems of alloy choice and fabrication. Further, Alcoa's recommendations will be unbiased, for our facilities permit production by sand, semipermanent, or permanent mold casting; by forging, impact extruding, welding, or whatever other method is called for in your particular case, to give *you* best results. ALUMINUM COMPANY OF AMERICA, 2141 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in principal cities.

MORE people want
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FIRST IN

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Diesel Manufacturers Get Hearing On Proposed Tariff Agreements

By WILLIAM J. MADDOX
Chief, Diesel Progress Washington Staff

THROUGH the efforts of E. J. Schwanhausser, and Harvey T. Hill, President and Executive Director of D.E.M.A., respectively, the Reciprocity Information Committee granted a hearing on January 28th last. The subject discussed was certain proposed downward revision of tariff rates on Diesel engines coming into this country. Present were E. J. Schwanhausser, Vice President, Worthington Pump and Machinery Corporation; Carl H. Vaupel of Cooper-Bessemer Corporation; Donald Reynolds of M.A.P.I.; Harvey T. Hill; and T. W. Drennen and C. W. Lincheid, New York Branch Manager and Export Manager, respectively, Fairbanks, Morse.

Acting as spokesman for the Diesel Engine Manufacturers, Mr. Schwanhausser made it clear that the Association which he heads is not opposed to tariff agreements; it however wants them to be equitable. It does not want a lot of engines going out nor a lot coming in. He pointed out that manufacturing facilities are about three times greater today than before the war. Also that some export business is needed to keep these facilities busy. Mr. Schwanhausser further stated that it was felt that the balance of tariffs in effect before the war were substantially right to enable the industry to grow. He stressed the essential role that Diesels played in the war and argued the maintenance of our Diesel engine productive capacity against possible future emergency.

Mr. Schwanhausser admirably presented the case for the Diesel Engine Manufacturers and it may be said that the members of the Reciprocity Information Committee were extremely friendly. The Committee requested a written report from the Diesel delegation setting forth their views on what action will be helpful in selling Diesel engines abroad.

Weber Heads Quincy Service Depot Program

M. J. WEBER has been selected to head the Authorized Service Depot Program of the Quincy Compressor Co., Quincy, Illinois. Announcement of this appointment was made recently by Roland Lehr, sales manager of the company. Mr. Weber, as service manager, will supervise installation and maintenance of Quincy Compressor parts and service departments which have recently been set up in principal cities throughout the country. Mr. Weber has been associated with the company for the past 14 years. His experience was gained in the manufacturing end of the business. More recently, he has been the head of the Quincy parts department.

Ingalls Locomotive for Southern Railroad

Ingalls 1500 hp. Diesel Electric Locomotive

THE first Diesel-electric locomotive built in the South is in service for the Gulf, Mobile and Ohio Railroad, hauling between Mobile, Alabama and Laurel, Mississippi. The locomotive is powered by a 1650 hp. Superior Diesel and equipped with Westinghouse generators and motors. According to GM&O officials the new locomotive hauls 80 cars of gravel on its run at a lower cost and with better performance than the former steam locomotive.

Past, Present, and Future of Diesel Locomotives

. . . . *Continued from page 63* . . . .

compare favorably with the Diesel.

Furthermore, these materials are extremely difficult to work, are very expensive, and their useful life is far below anything that could be considered suitable for locomotive work.

2. The gas turbine is extremely sensitive to air intake temperature. Horsepower and efficiency drop off very rapidly with an increase in intake temperatures. This characteristic is very important in locomotive work because ambient temperature variations from —30° F. to +110° are not uncommon.
3. It requires about 4 times the quantity of air used by a Diesel, therefore, the parasitic loss of power is very substantial.
4. Acceleration of the unit is very low.

We and other manufacturers are trying to find out how to lessen or remove these deficiencies.

If we find that a gas turbine can be successfully designed and manufactured with cost economies and reliability equal or better than Diesel, we can then install a gas turbine in the place of our present Diesels.

However, from what we know now, it appears that the railroads will make a lot of money off of the Diesels they now own and will buy for some time to come, before the Diesel is supplanted by gas turbines.

Gulf Coast Marine Diesel Conference

ADVANTAGES of Diesel engines in cargo ships, tankers, workboats and other vessels, together with the best practices in Diesel engine maintenance and usage, will be the theme of a Gulf Coast Marine Conference to be held March 20 at the Roosevelt Hotel in New Orleans, by the Diesel Engine Manufacturers Association. The conference is the second in a series, the first having been held last November in San Francisco. A third meeting will be held later in the year at New York, for the Atlantic Coast maritime interests.

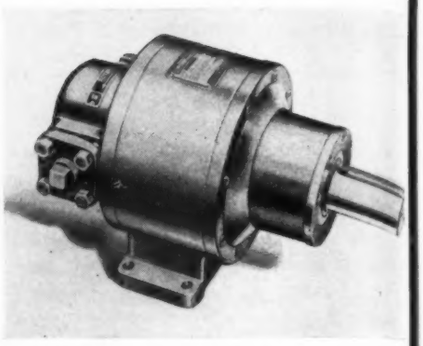
Attending the New Orleans Conference will be Diesel engine manufacturers from all sections of the United States. They will have as their guests, naval architects, shipbuilders and ship operators of the Gulf Coast region. One of the features of the meeting will consist of a group of Diesel engine users, representing all types of marine applications, who will tell of their experiences with Diesels.

Diesels Haul New Great Northern Empire Builders

A NEW 45-hour service between Chicago and Seattle was announced recently by President F. J. Gavin of the Great Northern Railway. The five new Diesel streamliners which comprise the fleet of *Empire Builders* will clip 13½ hours from the present schedules of passenger trains over the northern route. Each train will consist of twelve cars of the newest type and will be powered by a two unit, 4000 hp. Diesel locomotive.

Superdraulic Announces Small High Pressure Pump

A HYDRAULIC pump developing 5,000 pounds per square inch, yet small enough and light enough for a boy to handle—that's the description which the Superdraulic Corporation gives to its new "Superdraulic Junior" hydraulic pump. As the name implies, the Superdraulic Junior is practically a duplicate of the famous Superdraulic 40 horsepower Constant Delivery Pump on a reduced scale. It is only six inches in diameter, 11 inches long, and weighs approximately thirty-five pounds. It delivers 5,000 pounds per square inch in continuous duty service. The single bank of plungers delivers three gallons per minute at 1,800 rpm., and two gallons per minute at 1,200 rpm.



"Superdraulic Junior" Pump

It is predicted that the new pump would meet with wide acceptance as a means of hydraulic power application to machinery where space is at a premium and yet where the flexibility and control afforded by hydraulic power is desirable.

Illustrated descriptive literature about the Superdraulic Junior Pump may be had by addressing Superdraulic Corporation, Miller at Ford Road, Dearborn, Michigan.

The Cause and a Cure of Contamination in Diesel Cooling Systems

DIESEL engines require positive and effective cooling if they are to operate efficiently with minimum maintenance. Liquid cooling, with water as the medium, is the system commonly employed. Thus, with correct design and construction as a premise, the operating requirements are: 1) unimpeded circulation, 2) direct contact between the water and the surfaces to be cooled, and 3) absence of corrosion.

The impurities contained in water obtained from natural sources often result in failure of the system to meet the above requirements. They may be grouped as follows: 1) dissolved minerals which cause insulating scale deposits; 2) suspended or dissolved organic matter which may form slime and other residues; 3) dissolved gases, without which rust and other corrosion is unlikely to occur.

The presence of dissolved minerals causes scale in two ways. Soft scale is deposited because of a heat-induced change of some minerals from a soluble to an insoluble form. Hard scale is deposited because, through water evaporation and addition of makeup, the concentration

tends to exceed the maximum possible with resultant precipitation.

Organic matter in the water tends to slime under the action of heat, and algae may grow thereon under the proper conditions. Thus the metal surfaces become coated and piping may clog.

Both scale and organic matter cause reduction in the circulation rate and, because of their insulating character, reduce the rate of heat transfer from metal to water.

It is impractical to eliminate these difficulties by the use of distilled water. Therefore, the use of an additive which will prevent scaling, the accumulation of organic residues and slimes, and inhibit the normal action of dissolved oxygen and other gases in producing rust and corrosion is indicated.

Such an additive in the form of a compounded chemical powder has been developed and is being marketed by Kenite Laboratory, Inc. Added to the water in relatively small concentration, it has been found effective in preventing the difficulties mentioned. In addition, existing accumulations of scale, rust and organic matter are removed by this compound for it digests them, forming a very finely divided precipitate which is readily flushed.

The action of the compound in removing existing accumulation is relatively low, but very effective. Organic matter and soft scale is reduced in a few hours at normal operating temperatures.

The compound contains no harsh acids or caustics. It is harmless to the cooling system as well as to personnel. This is considered an important factor, inasmuch as carelessness can in no way result in injury to the engine.

This compound is a variation of a boiler water treating compound which has been in successful use for the past years by industrial, public utility, railroad and marine organizations, as well as the heating trades, for the cleaning of boilers and treatment of makeup water. The original compound operates at reasonable speed only at temperatures at or near the boiling temperature. In adapting it for use in Diesel engine water cooling systems it has been adjusted to operate more rapidly at the normal operating temperatures of these systems.

For full particulars write Kenite Laboratory, Inc., 83 Murray Street, New York 7, N. Y.

The pint-sized tug "Pushover" exercises her Diesel in Stamford harbor.

"PUSHOVER" A TUG'S TUG

THE Luders Marine Construction Company of Stamford, Connecticut has developed a little 21 foot towboat, the *Pushover,* designed for use around their yard. This boat is powered with a one-cylinder, two-cycle Gray Marine Diesel which will develop 25 hp. As utilized in the tug it develops 16 hp. with a slightly more than 3-1 reduction gear.

This little boat while it only has a speed of 8 mph. moves 100 foot steel tugs around with quite some authority and when it handles craft more in its weight class it nearly maintains its 8 mph. speed.

It has the very popular Luders patented bow and also rounded transom corners to minimize damage around docks. A tow post slightly aft amidships allows for excellent maneuvering when at the end of a tow line.

The design was experimental in one respect as it was to be a prototype design for some proposed tugs of considerably larger size, where the "V" bottom construction of this boat could be incorporated without loss of speed or seaworthiness, and with a considerable saving in cost.

The boat is substantially built with good engine foundation and practically vibrationless.

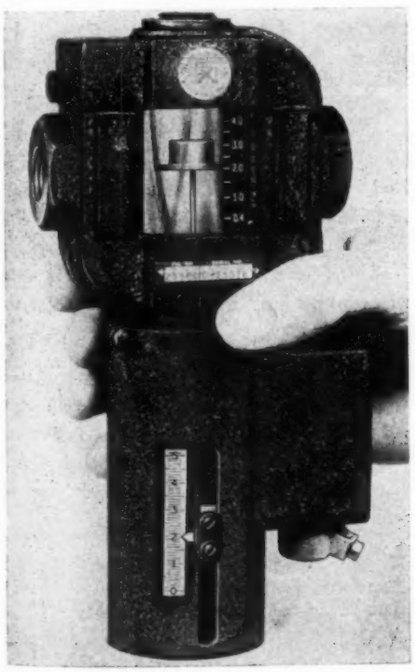
New Falk Coupling Bulletin

SELECTION of just the right coupling for the job is a simple matter when you have the new Bulletin #4100 on Falk Steelflex Couplings just issued by The Falk Corporation. In addition to giving detailed illustrations and descriptions of the new and improved Type F Steelflex Couplings, the most complete, simplified selection tables are provided. Falk's new standardization which results in a wider range of application for one standard type of Steelflex Coupling, plus the new selection method used in this bulletin, makes for greater accuracy in selection and simplified installation.

Eight other types of Falk Couplings developed to meet special purposes are also illustrated and described in the new booklet. For your copy of Bulletin #4100 write The Falk Corporation, Milwaukee 8, Wisconsin.

Rato-Sight Flow Rate Alarm

FOR visible and audible protection against dangerously low or high flows of liquids and gases Fischer & Porter has developed the new Rato-sight Flow Rate Alarm. Valuable and critical equipment that can be ruined by failure of a cooling or lubricating flow, or a process or product that could be spoiled by excessive flows may be safeguarded with this new device.



Rato-sight Flow Rate Alarm

The Rato-sight Alarm operates through a float which moves up and down a pyrex tube into which triangular flutes have been fashioned. As the float rises, the area within the tube increases, causing the float to assume a position in the tube in direct proportion to the flow rate. A magnetic extension on the float trips an external switch to operate the alarm circuit. The Alarm flow point is adjustable over the entire flow range and operates accurately at the set position.

Bulletin 92 with full description will be sent to you gladly. Write to Fischer & Porter Company, Hatboro, Penn., Dept. 5E-11.

Gallaway Heads Nordberg Midwest Territory

NORDBERG Mfg. Company announces the transfer of James H. Gallaway, District Manager of their Heavy Machinery Division, back to his former midwestern territory with headquarters again at Kansas City, Missouri. For several years Mr. Gallaway was located at the home office in Milwaukee engaged in special work in connection with wartime Diesel engine production. His address is the Ambassador Hotel, 3560 Broadway, Kansas City, Missouri.

American Locomotive Appoints Holmes Brown

Holmes Brown

APPOINTMENT of Holmes Brown as director of public relations of the American Locomotive Company was recently announced by President Robert B. McColl. He succeeds Lynn Mahan, who has resigned to form his own public relations organization.

In his new assignment Mr. Brown will supervise all advertising, sales promotion and publicity activities. George Mason was appointed assistant director of public relations. He is also director of information.

Mr. Brown has been associated with American Locomotive since October, 1945, when he became director of advertising and sales promotion. Previously he was advertising manager of the Pennsylvania Rubber Company of Jeannette, Pa., and, prior to that, was associated with the General Electric Company. In 1936 Mr. Brown was graduated from Iowa State College.

A former Boston newspaperman, Mr. Mason was director of public relations for Pennsylvania-Central Airlines in Washington before entering the Army Air Forces. He joined American Locomotive in 1945 after three years of service.

Fairbanks, Morse & Co. Announce New Manager For Their Chicago Branch

R. H. MORSE, Jr., Vice President and General Sales Manager of Fairbanks, Morse & Co., Chicago, recently announced the appointment of John S. King as Manager of the Chicago Branch House of the company, succeeding Frank V. Roy who retired from that position which he had long held, on March 1st, 1947.

Cut Engine Trouble, Wear Breakdowns, Teardowns--

with Fram Filters and Cartridges!

FRAM HEAVY-DUTY LUBE OIL FILTERS

Engineered for efficient adequate, economical filtration of lubricating oil on practically any type of Diesel, gasoline or gas engine.

Fram heavy-duty lube filters romove dust, dirt, grit, sludge and abrasives from oil, minimize wear, cut breakdowns. Thus, Fram saves overhauls, repairs and costly delays—lengthens the life of engines.

FRAM FILCRON FUEL OIL FILTERS

Made in two sizes to service all types of Diesel engines. May be used individually or in multiple to meet any desired capacity. Scientifically designed, guaranteed to remove all solid particles from fuel.

Fram Filcron Fuel Oil Filters contain the amazing Fram Filcron cartridge, which proved itself an outstandingly efficient filtering agent in widespread Army and Navy use during the war. Made up of stacked cellulose discs, the Filcron cartridge removes particles as small as one micron (.000039 of an inch) in size . . . thus provides absolutely clean oil to injectors, saving maintenance and money.

For information on Fram Lube or Fuel Oil Filters, write: Fram Corporation, Providence 16, R. I. *In Canada:* J. C. Adams Co., Ltd., Toronto, Ontario.

FRAM OIL AND MOTOR CLEANER

Cleans the Oil that Cleans the Motor

New Massey Governor

THE Massey Machine Company have recently announced a new hydraulic isochronous governor suitable for marine, stationary or locomotive Diesel application. The new governor is the end result of long experience and research and incorporates unusual design features. Most outstanding of these is the elimination of springs in the speeder head and compensating systems. This feature allows very accurate adjustment of the governor making for great sensitivity over the entire range of engine speeds. This is made possible by varying the hydraulic control pressure to compensate for the changes in centrifugal force of the governor flyballs both in the high and low speed ranges.

New Massey isochronous hydraulic governor.

Safety protection against failure of the governor oil pressure is an inherent feature of the basic design. If for any reason the oil pressure should begin to fail, the pilot valve immediately lowers and causes the power piston to decrease fuel. If the pressure continues to fail, this system will shut the engine down. A new catalog, No. H-245, has been prepared which describes the new governor fully. Write the Massey Machine Company, 800 Pearl Street, Watertown, N. Y.

Ladish Changes Name

IN a move intended to better reflect the expanded scope of the company's activities, Ladish Drop Forge Co. of Cudahy, Wisconsin, announced recently that the corporate name has been changed to Ladish Co.

It has been felt for some time that the inclusion of the specialized term "drop forge" in the company name may have implied a limitation of products to many industries and business people, particularly users of one of the Ladish major product lines, namely, Forged and Seamless Welding Pipe Fittings.

Schachner Holds General Motors Distributorship on Coast

MAX SCHACHNER'S many friends will be interested to know that he and his sister, Miss Rosalie Schachner, have launched a new venture, the Seaboard Equipment Co. of Newport Harbor, Cal. Both are veterans of the late war, Miss Schachner in Spars, her brother as a major in the Army. Max Schachner, prior to the war was associated with General Motors Corporation and his development work on the 2-cycle Diesel engine was outstanding. Now he has been awarded the distributorship for General Motors Diesels in Arizona, Southern California and Nevada. Their Seaboard Equipment Company offers complete engine rebuilding service as its new repair department at 1205 Coast Highway. We wish them well on their new project.

Benjamin's Takes Over Viking Yard

THE 7 acre Viking Shipyard at Mill Basin, Brooklyn, New York, has been taken over by Benjamin's for Motors, the large dealer in industrial and marine equipment.

A new building is being erected to house a complete machine shop that will cost $200,000, making it one of the finest repair yards on the East Coast for small and medium size craft. They specialize in rebuilding Diesel and gasoline engines, conversions and general marine repairs. In addition, there will be a sales showroom of new and used marine equipment. Tom Joynes, former Superintendent of Todd Shipyard in Brooklyn and Newport News Shipbuilding and Drydock Co., is head of the Marine Division.

Accident Prevention Manual

AFTER two and a half years of research and preparation, the National Safety Council has published its new "Accident Prevention Manual for Industrial Operations." The 544-page manual, containing 400 illustrations, charts and tabulations, is intended as a handy and authoritative source of accident prevention information for safety directors and safety engineers.

Although prepared primarily for the manufacturing industries, much of the information is applicable to non-manufacturing industries and to those with industrial operations, such as railroads and ship operators. The manual is available to both members and non-members of the Council. Further information may be obtained by writing the National Safety Council, 20 North Wacker Drive, Chicago 6, Ill.

Santa Fe Acquires Six F-3 Diesels

New 6,000 hp. Diesel-electric locomotives.

THE first application of the new F-3, the wide range Diesel locomotive built by Electro-Motive Division of General Motors Corporation, was announced recently when Fred G. Gurley, President of the Santa Fe Railway, stated that six of these locomotives had been delivered to the Railway and added to the Railway's power pool from which is drawn the engines for the Super Chief, Chief and other high speed passenger trains.

By a simple adjustment to one of its seven standard gear ratios the F-3 can be equipped to perform over a range from that of the heaviest dragging freight locomotive for mountain terrain, with a maximum speed of from fifty to sixty-five miles an hour, up to that of a heavy duty passenger locomotive capable of pulling long, standard weight Pullman trains at one hundred miles an hour, over most mountain grades without a helper.

Each Diesel engine is equipped with an electro-hydraulic governor control having automatic protection built into it to guard against low oil pressure and excessive vacuum on the oil pumps, which provides better protection to the engine for preventing lubrication failures.

Alco Realigns Executive Organization

MODERNIZATION of the American Locomotive Company's executive organization to meet changing conditions in the railroad equipment field was recently announced by Robert B. McColl, president. Mr. McColl said that American Locomotive has completed a transition from the primary function of constructing custom-designed steam locomotives to the mass production of a completely new line of Diesel-electric locomotives. He explained that the organizational changes have been made to meet the new and accelerated tempo of railroad motive power requirements.

A new administrative committee was appointed by Mr. McColl to plan, direct and coordinate all company activities, as a part of the new organization plan. Members of the committee are Vice-Presidents Perry T. Egbert, William L. Lentz, William S. Morris and Norman C. Naylor; Herman Press, treasurer, and James D. Vaughan, comptroller. Duncan W. Fraser, chairman of the board of directors, will serve, ex-officio, as a member of the committee. Mr. McColl will preside over the committee.

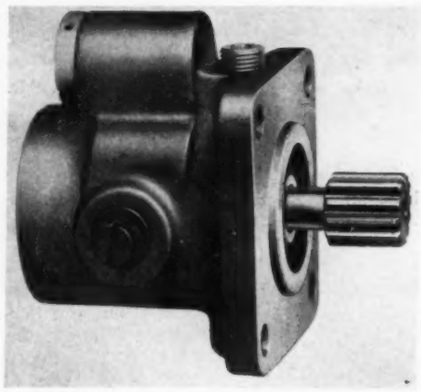
Vice-President Egbert has been appointed to head all Diesel-electric and steam locomotive activities, including locomotive spare parts and marine and stationary Diesel engines. Mr. Egbert's department will have headquarters at the company's locomotive plant in Schenectady, N. Y.

Vice-President Morris has been placed in charge of Alco's other three divisions—Alco Products, Railway Steel-Spring and the Canadian affiliate, Montreal Locomotive Works, Ltd. Mr. Morris will make his headquarters in New York. He became a member of the board of directors recently.

Vice-President Naylor, in addition to being a member of the policy committee and board of directors, will direct and coordinate the sales of all American Locomotive divisions with headquarters in New York.

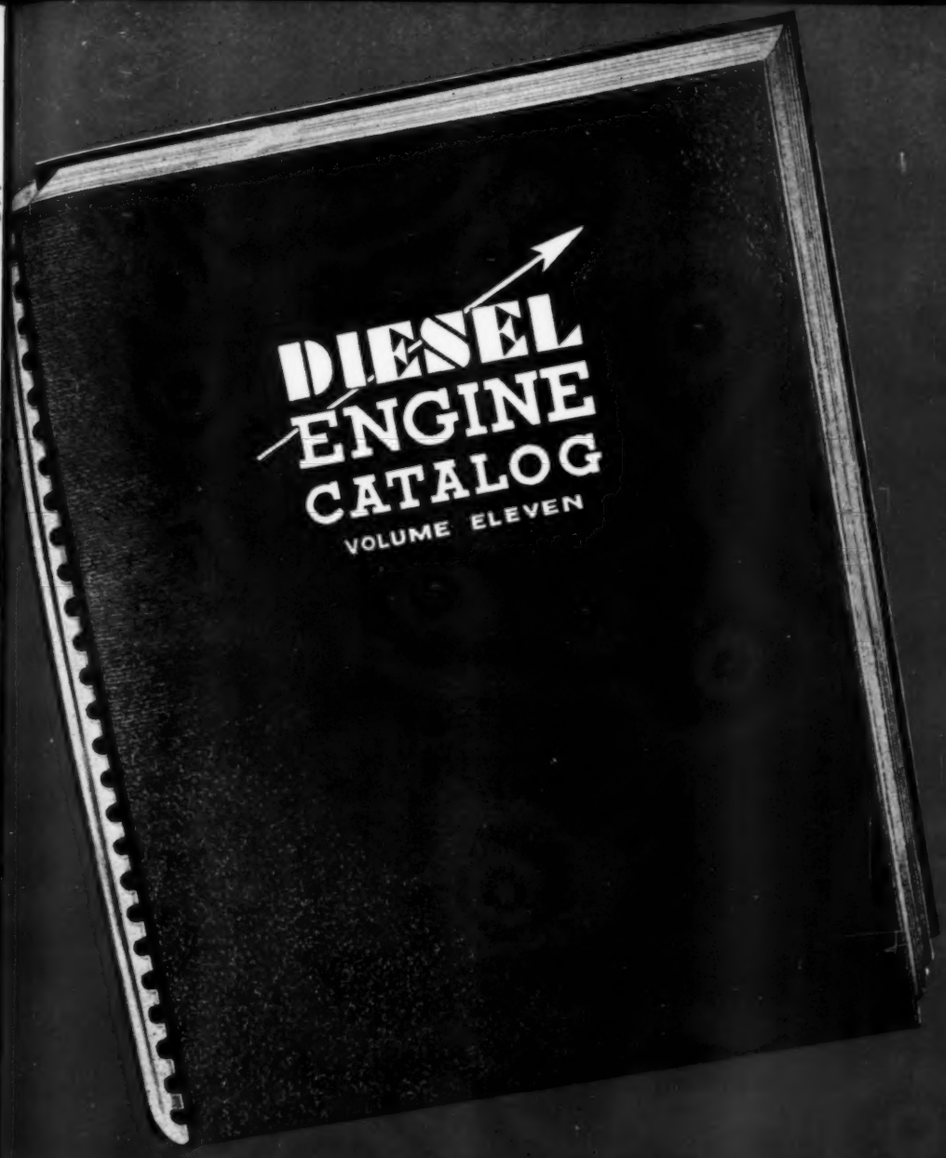
William E. Corrigan was named vice-president in charge of eastern regional sales with headquarters in New York. Mr. Corrigan has been associated with the company since 1909, when he started a four-year course in locomotive construction. He served as an officer in the Artillery Branch of the United States Army in World War I. He has held many important positions in the company and was elected vice-president in 1937.

New 14 oz. Fuel Pump For Marine Engines



New Romec Pump

A NEW vane type non-pulsating fuel pump has been developed for use on marine Diesel engines. This new pump weighs only 14 ounces and is available with various drive couplings and mounting flanges for engines and for electric motors. For marine Diesels it is applicable to all engines requiring up to 50 gal. per hour fuel delivery, and at fuel pressures up to 60 psi. with unfailing fuel delivery. It is manufactured by Romec Pump Company, 104 Abbe Road, Elyria, Ohio.



NOW AVAILABLE

THE WHOLE DIESEL INDUSTRY UNDER ONE COVER

Whether you are looking for the smallest Diesel engine or the largest, you will find it described and illustrated in the DIESEL ENGINE CATALOG, Volume 11, edited by Rex W. Wadman. What's more, you will find complete specifications on

819 DIFFERENT MODELS—

The Products of 54 Engine Manufacturers. Each engine description is complete and accurate — checked and double-checked by the Manufacturer himself. Illustrations include full-page engine views, lube and fuel system diagrams, also cooling systems—many traced in color.

But that is just the Diesel engine section. The Catalog also includes an accessory section carrying valuable information on the various Fuel Injection Systems, Gear and Chain Drives, Turbochargers, Blowers, Magnetic Couplings, all fully described and profusely illustrated.

FOR DESIGN AND OPERATING ENGINEERS AND BUYERS

There is a Market Place Section — a directory of Diesel engines classified as to ratings and speeds with manufacturers' names and addresses—and a Product Directory including accessories, parts, materials and services—all classified as to products. The Market Place tells you at a glance where to find what you want for your engine or plant.

NO OTHER DIESEL BOOK LIKE IT—
Over 500 Pages—
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1. The main section is devoted to descriptions, illustrations and specifications of all the Diesel engines manufactured in this Country.
2. A large section carries complete illustrated descriptions of Diesel engine and plant accessories.
3. The Market Place—a classified directory of Diesel Engines and Accessories.
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11th EDITION OF THE DIESEL ENGINE CATALOG

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The most widely-used Diesel reference book published:—Because the book is revised and brought up to the minute each year, thousands of design and operating engineers, purchasing and sales executives, Diesel students buy the DIESEL ENGINE CATALOG each year and constantly refer to it throughout the year. The 1946 Edition, Volume 11, embodies sweeping changes — new models and types, revised designs, and carries the basic information published in previous editions. Whatever your interest in Diesels is you will find this Edition of the DIESEL ENGINE CATALOG indispensable.

DIESEL ENGINE CATALOG—Two West Forty-Fifth Street—
New York 19, N. Y.

Enter my order today for a copy of the New Diesel Engine Catalog, Volume Eleven, Edited by Rex W. Wadman, for which I enclose $10.00.

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ORDER YOUR COPY NOW!

New Valve Seat Insert

WAUSAU Motor Parts Company Engineering Department has developed a new alloy for valve seat inserts that has all the heat resistant qualities of the high chromium tungsten steels but is in the price range of conventional cast iron inserts. By a chemical combination, excess amounts of molybdenum and chromium carbides are formed. The result is a white structure iron that cannot be machined. By a special foundry practice this product is changed to a tough machinable product. Laboratory cycle tests show these inserts will not take a set at the extremes of heating and cooling; and tests in a high output Diesel for 1000 hours, at full load throttle with thermocouple readings of an average of 1340° F. and water temperature of 160-180° F. showed these inserts still tight in the counterbore.

Ex-Cello-O Hydraulic Power Unit Bulletin

New 16-page booklet includes engineering information, installation drawings and application photos of the three sizes of Ex-Cell-O "package units" for feeding and rotating cutting tools.

General information is given on the use of these units in building economical special-purpose production machines, as well as specifications and feature details of each unit. Write for Bulletin 45361, Ex-Cell-O Corporation, Detroit 6, Michigan.

Young Radiator Announces Staff Additions

R. M. Rayner

P. J. Menden

THE Young Radiator Company recently announced the addition of three new members to their staff. The new members are: Ralph Rayner, who will assist in the research dept. of the company; P. J. Menden, who will assist in development and application engineering; and John P. Wahlen who will serve as sales engineer for the Heating, Cooling and Air Conditioning Division of the company.

John P. Wahlen

The company also announced the addition of the Carl H. Roath Company to their list of distributors. This company will represent Young Radiator in the Denver area.

Matzner Named by Mack Mfg. Corporation

ANNOUNCEMENT was recently made of the appointment of Leonard E. Matzner as Advertising Manager for Mack Manufacturing Corporation. Mr. Matzner had been serving the company in the capacity of Assistant Advertising Manager following his return from active duty in the Pacific theatre.

High Speed Earth Moving

THE accomplishments of rubber tired equipment on medium and long earthmoving hauls where ground conditions are conducive to the use of wheeled vehicles are recorded in the new booklet, "High Speed Earthmoving," published by Caterpillar Tractor Co.

Acknowledging the dependence on track-type tractors in pioneering work and under conditions where only tracks can cope with operating conditions, the publication focuses attention on high speed in earthmoving. Copies of the booklet may be obtained by writing for Form 9494 from the Caterpillar Tractor Co., Peoria 8, Illinois.

New Paxton Catalog

A NEW catalog showing in detail major items in the P-M Metallic Packing line has been released for distribution by Paxton-Mitchell Company and its subsidiary, Paxton Diesel Engineering Company.

The first section lists and displays P-M standard piston rod packing assemblies, valve stem and tandem style rod packing assemblies, steam pipe slip joint assemblies, and packing accessories. The second section is devoted to products of Paxton Diesel Engineering Company.

Detailed descriptions with large illustrations give important information about the *Bearing Watchdog System*. The *Safe-N-Ezy Valve Spring Depressor* for one-man dismantling and assembling of Diesel engine valves and the *Bingham Sleeving Process* for reclaiming crankshaft journals are also shown.

Write Paxton Diesel Engineering Co., Omaha 5, Nebraska, for a free copy of the catalog.

West Coast Diesel News

By FRED M. BURT

FOUR Caterpillar 130 hp. Diesel engines have been installed in a Richfield Oil Co. pipe line in the Taft, California area to supply pumping power. One 150 hp. Diesel was also supplied by Shepherd Tractor & Equipment Co., Los Angeles, to American Concrete Pipe and Construction Co. as a power replacement in a crane shovel.

LANG Transportation Co., Los Angeles, has taken delivery of four of the new, all-aluminum Kenworth chassis, powered with Cummins 6 cyl., 275 hp. Diesel truck engines, from J. T. Jenkins, Los Angeles distributor.

THE *Wasco* re-launched on the Columbia River, is a successful conversion from a 36 ft. LCV (landing craft, vehicle) into a practical commercial fishing boat, by D. L. Vaughn and Jas. H. Hoak, Portland; powered with a supercharged Gray Diesel engine, with a capacity of 225 hp. at 2500 rpm.

NINE 74 ft. Army ST tugs, 74 ft. long, powered by 400 hp. Imperial Diesel engines, are for sale as surplus at $40,000 each, by the U. S. Maritime Commission; seven located at Seattle, two at San Francisco.

POWERED by a turbocharged 6 cyl., 450 hp. at 300 rpm. Enterprise Diesel, is the new towboat *San Francisco* for the San Francisco Towing Co., Capt. John Pedracci.

ONE of the latest designs of H. C. Hanson, Seattle naval architect, is a 5 ft. steel combination fishing boat, specifically fitted for the tuna, bottom fish, halibut and salmon trolling fisheries, and powered by a 180 hp. Cummins

IF YOU HAVEN'T ORDERED YOUR COPY OF THE LATEST DIESEL ENGINE CATALOG, VOL. 11, BETTER DO IT TODAY, SEE Page 99.

AT Sagstad Shipyards, Seattle, under construction for Puget Sound fishermen are a 54 ft. purse seiner, powered with a 100 hp. Lorimer Diesel, for Haakon Thompson, Winslow, Wash.; and a 62 ft. halibut boat for Alfred Jangard with a 165 hp. Gray Diesel.

COMBINATION fishing boat *Mary V*, a 46 ft. 6 in. fantail, owned by veteran Broadbill harpooner, John J. Silva, San Diego, has just been completed and is powered with a 150 hp. Cummins Diesel, and a 10 kw. Bardco generating set for auxiliary power.

THIRTY-ONE hp. Sheppard Diesels have been installed for propulsion in San Pedro Jigboat *Mi Novia*, and in Monterey Jigboat *Clara;* an 18 hp., 10 kw. Sheppard Diesel auxiliary set was installed in small tuna vessel *Lil Evelyn*, San Diego.

TO operate with nets instead of set lines off the Mexican Coast for shark fishing, operations by Manuel Gueterra and associates, are the *National*, powered with a 110 hp. Atlas Imperial and with a 40 hp. Fairbanks-Morse auxiliary; the *Aguila II*, with a 90 hp. Atlas Diesel and 40 hp. F-M auxiliary.

RUSSELL A. STEVENS, recently released from four years as lieutenant commander in the Navy and a Diesel engineer of long experience, has become marine engine manager for Fairbanks-Morse & Co., Los Angeles, succeeding Ray Cooper who was transferred to manage the F-M Diesel engine department in Mexico City.

SAN PEDRO market boat *Georgia Boy*, owned by Dick Frances, has been re-powered with a 60 hp. General Motors Diesel and 3:1 Snow-Nabsted reduction gears; supplied and installed by Crofton Diesel Engine Co.

A NEW 105 ft. wooden tuna clipper being built at San Diego Marine Construction Co. will be driven by a 460 hp. Washington Diesel; two Atlas Imperials for auxiliaries.

TWO 42 ft. fishing boats built for R. Mostad and other interests by the Park Shipyards of Vancouver, will be powered with Buda Diesels with 3:1 reduction gears.

NEW dealers appointed by the Sterling Engine Company for their marine and stationary Diesel engines are Nuttall-Styris Co., for the San Diego territory; Fellows & Stewart, marine dealers for the balance of Southern California. PAKCO of Los Angeles continues to handle industrial sales and service in Southern California. A factory branch has been established to assist the dealers in the west coast states and Alaska, in the Russ Bldg., San Francisco with Hans Bohuslav, vice-president, and Al Hahn, assistant manager.

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